Sept. 1, 1925. 1,551,633

C. H. BENNETT

MIXER

Original Filed Oct. 25, 1919 3 Sheets-Sheet 1

Fig. 1.

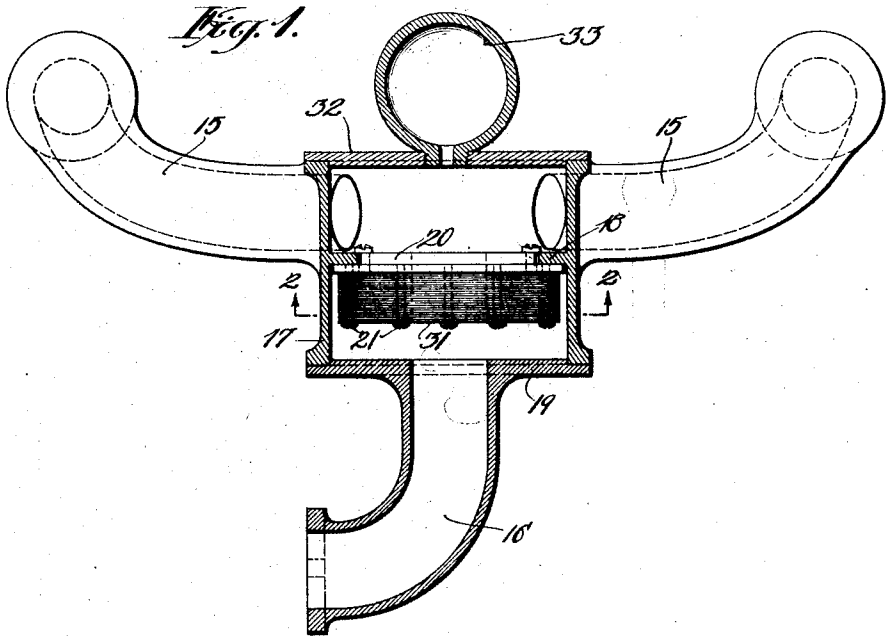
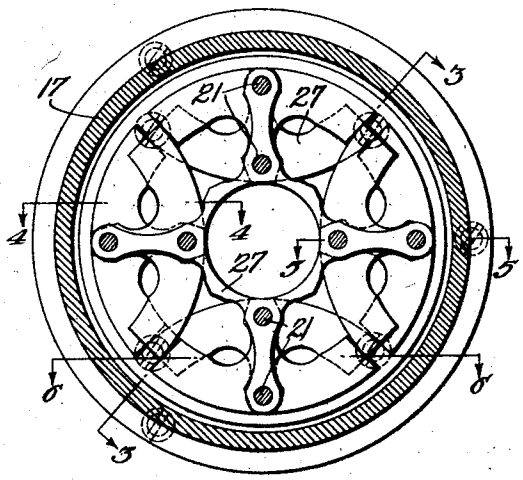


Fig. 2.



WITNESSES

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Sept. 1, 1925. 1,551,633

C. H. BENNETT

MIXER

Original Filed Oct. 25, 1919 3 Sheets-Sheet 2

Fig. 3.

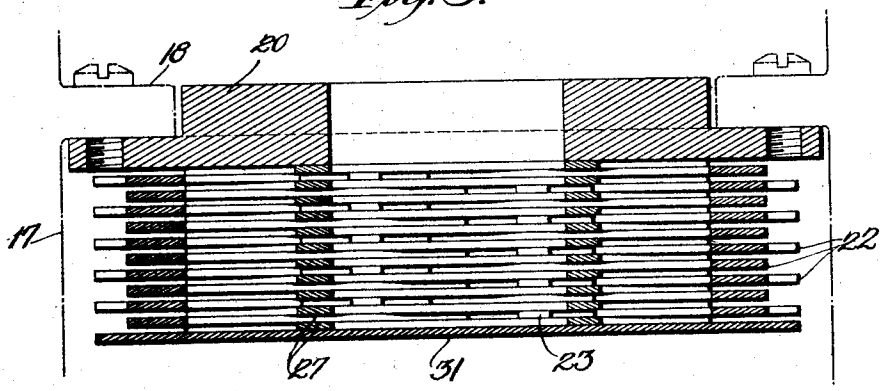


Fig. 4.

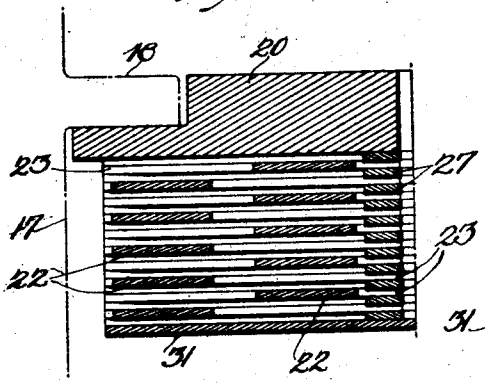


Fig. 5.

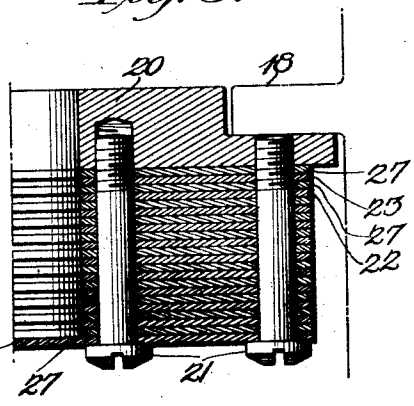
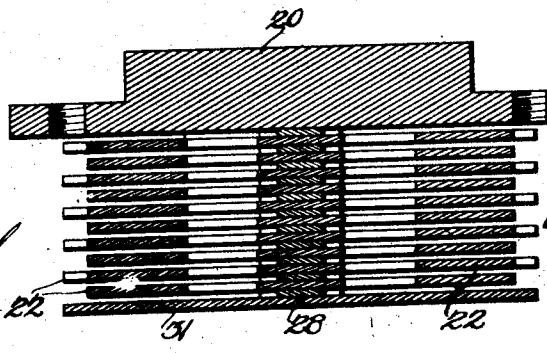


Fig. 6.



WITNESSES

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Sept. 1, 1925. 1,551,633

C. H. BENNETT

MIXER

Original Filed Oct. 25, 1919 3 Sheets-Sheet 3

Fig. 7.

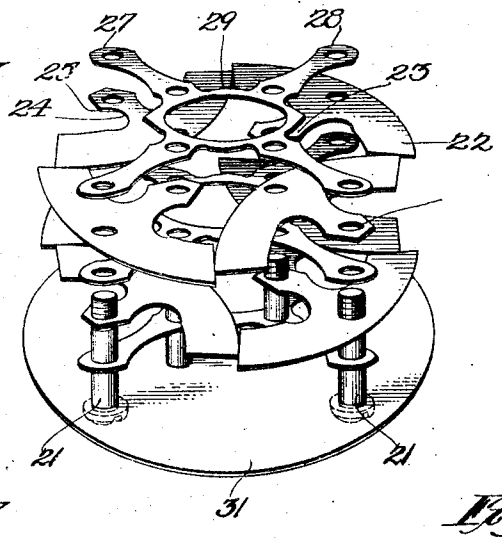


Fig. 8.

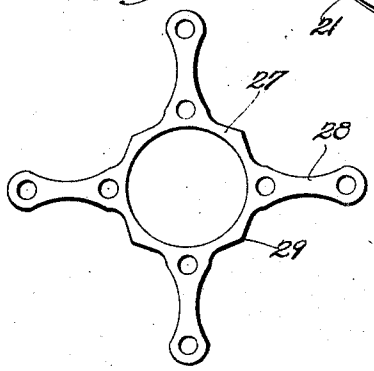


Fig. 10.

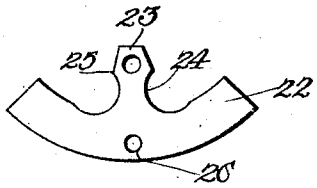


Fig. 11.

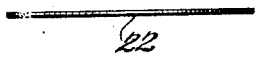
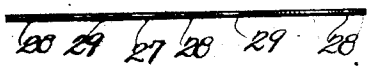


Fig. 9.



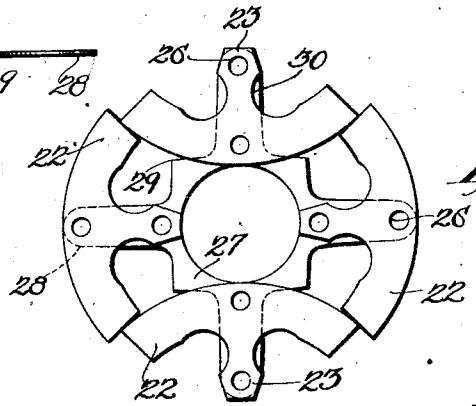


Fig. 12.

WITNESSES

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D. H. Amory

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Patented Sept. 1, 1925. 1,551,633

UNITED STATES PATENT OFFICE.

CLARENCE HERBERT BENNETT, OF JAMESBURG, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO BEN-WAT CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

MIXER.

Application filed October 25, 1919, Serial No. 333,177. Renewed April 23, 1925.

To all whom it may concern:

Be it known that I, CLARENCE H. BENNETT, a citizen of the United States, and a resident of Jamesburg, county of Middlesex, State of New Jersey, have invented certain new and useful Improvements, as embodied in the annexed specification, in Mixers.

It is a well appreciated fact that a constantly increasing problem has confronted both the users and manufacturers of internal combustion engines, more particularly where the same are applied to automotive vehicles, in that increasingly greater difficulty has been experienced in starting the engine particularly when it is cold. Also it is well understood that motors of the type specified have not produced maximum power in their initial steps of operation, or even after they have been running for a considerable period.

This decrease in efficiency, despite continual improvement in construction, is the result of the constantly lowering standard of volatile fuels employed as the source of energy for internal combustion engines.

In an effort to overcome this difficulty automotive engineers have resorted to what is known as a "hot-spot" manifold, in an effort to induce a more completely vaporized fuel mixture so as to insure a more efficient operation of the engine into which it is introduced. Aside from the structure above referred to, numerous devices and systems have been suggested with a view of producing a more readily combustible fuel mixture, which would result in an increased power on the part of the engine and easier operation as well as the elimination of carbon deposits.

All of the difficulty experienced as above outlined has been the result of placing upon the market fuel which is not readily vaporized. In other words, entire particles of fuel have been carried up by the suction of the engine directly into the cylinders, which particles or drops could not possibly be consumed in the brief interval devoted to the explosion stroke within one cylinder. As is well known, even under the most ideal conditions, not more than two-thirds of the entire fuel mixture introduced into the cylinder has been consumed during the explosion stroke. This condition may be attributed to the fact that the various particles going to make up the finished fuel mixture are not minutely subdivided and intimately co-mingled. These conditions, aside from lowering the actual operation efficiency of the engine under running conditions, have caused mechanical impairment in a number of ways, the most well known of which are the depositing of a layer of carbon on the side-walls of the cylinder and the creeping of raw gasoline past the pistons and associated piston rings into the crank-case causing a dilution of the lubricating oil and a consequently rapid wearing of the bearings and other rubbing parts.

With a view of solving this problem I have produced a mixer which will insure a more efficient fuel mixture resulting in improved operating conditions in the motive power into which it is introduced.

My device is primarily a mixer and is more particularly intended for use in connection with a carbureter and is adapted to be interposed between the same and the manifold of an internal combustion engine.

I am well aware that any number of devices have been suggested with this purpose in mind, but it is primarily pointed out that these devices have usually consisted of a wire screening or similar element which was interposed in the fuel line with a view of breaking up the particles of the mixture. While these devices have proven practical to a certain extent, at a slow R. P. M. of the engine, inefficiency of operation has resulted when the engine was speeded up. In other words, as proven by actual tests, it has been usually noted that in using devices of this nature the results have been entirely satisfactory, at an engine speed anywheres up to 1200 R. P. M., according to the type of motor, but unsatisfactory results have been noted at a higher speed of the same, this being attributable to the creation of back pressure, and to the general resistance offered to the flow of mixture by the baffling means.

As aforestated, my invention aims to produce a mixture by means of which the engine into which the fuel is fed will show an increased H. P. at equal R. P. M. or an increased R. P. M. at an equal throttle opening after my device has been applied to the unit, resulting in a saving of fuel.

Another object of my invention is to produce a mixer which will permit of an easier starting of the motor.

A further object of my invention is the production of a mixer which will operate, if anything, better, at a high R. M. P. of the motor, although functioning in an entirely satisfactory manner at slow speeds of the engine.

In connection with the satisfactory mixing of fuel by even the best of carbureters, it is pointed out, as aforestated, that whole drops of fuel are carried up by the inflow of current into the cylinders. For this reason I have constructed my mixer in such a manner as to prevent the passing of any drops of fluid in their raw state until they have been completely mixed.

A still further object of my invention is the construction of a mixer which shall combine compactness together with ease of assembling, which will result in cheapness of production.

Reference is had to the attached sheets of drawings which illustrate one practical embodiment of my invention and in which:

Figure 1. is a sectional side-view taken through a mixer constructed in accordance with my invention.

Figure 2. is an enlarged sectional plan view taken on lines 2—2 of Figure 1.

Figures 3, 4, 5, and 6. are enlarged sectional views taken along lines 3—3, 4—4, 5—5, and 6—6, respectively, of Figure 2.

Fig. 7 is a perspective view of the baffling means employed and showing the units of the same in loosely assembled position.

Figures 8, 9, 10, and 11. show certain details of the mixer and Figure 12 is a plan view of the initial assembled units of a mixer embodying a slightly different form of spider.

In all of these views like reference numerals designate similar parts, and the reference numeral 15 indicates any approved type of manifold applied to a fuel-consuming unit and 16, a pipe conveniently attached to the carbureter. Interposed and connecting these two members is the mixer.

The mixer includes a cylindrical casing 17, conveniently provided with an inwardly extending flange 18, positioned approximately intermediate the two ends of the casing 17. The lower end of the casing is closed by a plate provided with a central opening into which extends the pipe 16, the body of the casing 17 being further formed with any number of desired openings with which the manifold 15 may connect.

Secured to the flange 18, in any approved manner, is a collar such as 20, provided with a central opening. Bolts such as 21 are associated with such collar and extend upwardly therefrom for a purpose hereinafter more fully specified.

As has been clearly shown in Figures 2, 5, and 7. the bolts 21 are conveniently arranged in pairs at diametrically opposed points in the collar 20. Mounted upon such bolts are the members producing more complete mixing, these members constituting the baffling means and embracing what might be termed anchor-plates, including a body portion 22 and a stem 23, it being noted that such stem is provided with a reduced portion 24 and projecting portions 25, as well as openings 26. The baffling means further embraces a number of spiders each including a ring-shaped portion 27, having associated with it radially extending arms 28, also forms a part of the mixing members, it being noted that the ring-shaped portion of the spider is provided with projecting shoulders 29 for a purpose more clearly hereinafter brought out.

I prefer to assemble the baffling means of the mixer in the manner most clearly shown in Fig. 7. In this figure it will be noted that the bolts 21 which extend from the collar 20 have an imperforate plate 31 disposed upon their bodies. A spider of the type aforedescribed is now positioned upon these bolts which latter pass through the openings provided for this purpose in the spider. A series of anchor-shaped plates are next disposed upon the bolts 21 by having the shanks of the latter pass through the openings provided in these members, and it will be seen in the figure referred to, as well as in Figure 12 that these plates are conveniently so arranged that the stems and bodies of alternate plates extend in similar directions. In other words one plate has its stem extending inwardly towards the central opening, while the next adjacent plate has its stem extending outwardly for a purpose hereinafter specified.

A second spider is subsequently applied to the bolts 21 after the positioning of one layer of the anchor-plates, and a second layer is then arranged upon the bolts 21, it being noted, however, as has been clearly shown in Figure 7, that the second layer of anchor-plates, although carrying out the same alternate arrangement, i. e., two plates having their body portion extending inwardly towards the opening while the two other oppositely arranged plates have their stems projecting inwardly, that these plates are arranged so that the body portion of one plate extends outwardly, as against the positioning of its next adjacent underlying plate, whose stem projects outwardly.

And a third layer of anchor plates is now applied to the bolts, and the positioning of another layer of plates carried, care being taken, however, that each of these plates alternate both with respect to their next adjacent plate as well as their underlying plate.

By this arrangement, reference being had

more particularly to Figures 3 and 4, it will be seen that a venturi action is exerted upon the fluids passing between the spiders and plates, by virtue of the fact that the spacing of the outer elements, in other words the body portion of one anchor plate is spaced from the next over lying or under lying plate, a distance approximately 3 times as great as the distance between the ring shaped portion 27 of the spiders which are but one third of this distance apart. Thus the flow of fluid is accelerated upon passing inwardly towards the common center. Further, it is to be noted that various pockets are formed, that is, openings extending through the entire group of plates, as has been clearly shown in Figures 3, 4, and 6 which produce successive compression and expansion on the part of the gases passing between the plates, although the action as a whole increases the speed of the fluid flowing through the mixer.

It is to be noted that by virtue of the reduced portions 24 of the stem 23 that virtual pockets 30 form a part of the mixer.

It will now be noted, assuming that there has been applied to the outermost unit of the mixer a plate such as 31, that the gas will flow through the mixer from the pipe 16 and into the cylindrical casing 17 and between the plates, the current flow while passing through such plates being repeatedly speeded up and retarded by virtue of the increased or decreased space which may be occupied by the same in passing through said mixer. Attention is invited to the fact, however, as aforestated, that the speed of the flow of current has been generally speaking greatly increased, due to the venturi action, from the initial introduction of the fuel into the cylindrical casing 17 to the time of its emergence from the centrally located opening of the collar 20.

It will be seen that the anchor-plates are so mounted that a slight space is provided between the edges of the body portion of one plate and its next adjacent plate. In operation this will result in the free edges of the body of the anchor-plates vibrating, which is permitted by virtue of this spaced mounting. This vibration, as will readily be appreciated, will result in a minute subdividing of the particles of fuel mixture, which action will further be enhanced by the projections 25 and 29 of the plates and spiders respectively. This action is entirely aside from the action produced on the fuel mixture by the sharp edges and corners of the spiders and anchor-plates.

With a view to insure against any possible passage of drops of raw fuel through the mixer, the anchor-plates are cut out, as has been indicated by the reference numeral 24, to provide pockets 30 as has been clearly shown in Figure 12, in which assembly the sides of the spider arms 28 are straight, and it will be understood that while these large particles of fuel are capable of entering between the body portions 22 of the anchor-plates, that they will lodge in the pockets 30 formed by such plates as have their stems 23 projecting outwardly. Obviously, it will be impossible for these drops of raw material to creep inwardly in their original form, and it will be appreciated that such drops will be evaporated by the inrush of fluid past them and so absorbed, in a minutely subdivided state, in the fuel mixture.

It is now to be noted that the portion of the cylindrical casing 17 above the flange 18 forms an expansion chamber which causes a slowing down of the greatly accelerated flow of fluid emerging from the central opening in the collar 20, and if it is desired means may be provided which will tend to prevent a spasmodic flow of mixture. This is accomplished by forming an opening in the cover plate 32, and attaching a bulb-like element 33 to this opening. A bulb of this nature, although operating by vaccuum instead of by pressure serves to produce the same effect as that of a conventional pressure bulb associated with an ordinary pump in that a certain degree of vacuum exists within the bulb at all times during the operation of the mixer, and thus this member will act to equalize to a certain extent, the flow of the fluid through the mixer casing.

In operation: it has been found, considering each of the plates and spiders to be .01″ in thickness, that the outwardly extending body portions of the anchor-plates will be separated, in an assembled unit, by .03″ and that merely .01″ space will exist between the various units arranged directly below, or above, the central opening in the collar 20. This difference in spacing is caused by virtue of the fact, as will be readily appreciated from the foregoing description, that the ring-shaped portion 27 of a spider appears between each layer of the anchor-plates, thus providing a closed annular wall .01″ distant from its next over- or under-lying wall. This feature has been clearly illustrated in Figures 3. and 4. The .03″ spacing referred to is accomplished, as has been illustrated in Figures 3. 4. 6. 7. and 12., by the arrangement of the spiders and anchor-plates. In other words a longitudinal section through the baffling means reveals first an anchor plate having its body extending outwardly, a spider, an anchor plate having its stem extending outwardly, a second spider, a third plate having its body extending outwardly, a fourth spider etc.

Assuming that approximately twenty units are employed, considering that each unit incorporates one layer of anchor-

plates and one spider, it will be seen that 80 raw fuel pockets such as 30 are provided, aside from innumerable projections such as 25 and 29, which will cause a breaking up of the fuel, this action being further insured by the repeated increased and retarded flow of the fluid together with the vibration of the free edges of the anchor-plates.

By way of example: if a mixer constructed in accordance with my design were employed in conjunction with a four-stroke 3¾" bore engine, there would be approximately 176.7 cubic inches of displacement. In a motor of this type running at 1000 R. P. M., considering that the opening in the collar 20 were at 1 inch, there would be a flow of 88,350 cubic inches per minute through this opening. At this speed of intake, the speed of the fuel at the outer edges of the anchor-plate would be 9816 cubic inches per minute, which would increase as it neared the center of the mixer to a speed of 88,350 cubic inches per minute, subsequently decreasing as it entered the second expansion chamber formed above the flange 18 to about 5000 cubic inches per minute and leaving the expansion chamber by means of the manifold at an approximate speed, assuming that two 1" pipes were used, of 44,175 cubic inches per minute.

Briefly, it will be seen that, as has been afore-described, the fuel will strike the body portions of the anchor-plate and will be first broken up into small streams, any particles of raw material being restrained from further passage. These small streams are allowed to expand, subsequently being broken up into smaller streams which are in turn introduced into a common port.

By actual experiment it has been proven that the afore-described mixer insures a more intimate co-mingling and sub-dividing of the particles of the component parts of the fuel mixture, which results in avoiding, as has been further proven, most all the detrimental features incident to the use of low test fuel, and which will further permit of a fuel mixture being produced which will increase the efficiency of an engine, not alone during its actual performance but also with regard to the life of the engine.

It will be found in use that my device will produce improved results irrespective of the speed of the engine, thus overcoming objections to the devices of this type heretofore placed upon the market. This result is undoubtedly to be attributed to the venturi-like action of the mixer as a whole, which does not exert a retarding effect upon the flow of the fluid, but similar to the venturi employed in connection with various types of carbureters, increases the speed of the flow of the gases and also avoids establishing any back pressure.

From the foregoing it will be understood that all of the objects of this invention have been accomplished, and it will obviously be appreciated that, numerous modifications might be resorted to without in the least departing from the scope of my invention, such as producing the venturi action through the mixer by any desired arrangement of plates and spiders. Further, any number of accelerations and retardings of the current flow might be resorted to.

Having now described my invention, what I desire to claim and to secure by Letters Patent is:

1. A mixer comprising a casing and a unit including a plurality of anchor-shaped plates mounted within said casing and arranged one above the other in spaced relationship to each other to present interstices for the passage of the fuel mixture.

2. A mixer comprising a casing and a mixer unit including a plurality of substantially flat spiders and means for spacing said spiders arranged to form interstices for the passage of the fuel mixture.

3. A mixer comprising a casing and a mixer unit including a plurality of substantially flat plates providing an annular-shaped portion and a plurality of radially extending arms combined with superposed baffle plates arranged so as to form interstices for the passage of the fuel mixture.

4. A mixer comprising a casing, and a unit including a plurality of plates providing an annular shaped portion and a plurality of radially extending arms secured to said annular portion, said annular portion presenting shoulders in its outer edge.

5. A mixer comprising a casing, and a unit including a plurality of anchor shaped plates each comprising a pair of arms, and a stem, said stem being formed with cutout portions presenting pockets, and projecting portions.

6. A mixer, including a casing formed with inlet and outlet openings, a mixture breaking unit arranged around one of said openings, and said unit including an imperforate plate arranged opposite said opening, bolts having one of their ends secured to said plate, their opposite ends being secured to the inner face of said casing adjacent said opening, and a plurality of anchor shaped plates interposed between said casing and said first named plate.

7. A mixer, including a casing formed with inlet and outlet openings, a mixture breaking unit arranged around one of said openings, and said unit including an imperforate plate arranged opposite said opening, bolts having one of their ends secured to said plate, their opposite ends being secured to the inner face of said casing adjacent said opening, a plurality of anchor shaped plates interposed between said casing

and said first named plate, said anchor shaped plates being arranged in layers, certain of said plates having their arms arranged outwardly their stems projecting inwardly, adjacent plates having their stems projecting outwardly and their arms disposed inwardly.

8. A mixer including a casing formed with inlet and outlet openings, a mixture breaking unit arranged around one of said openings, and said unit including an imperforate plate arranged opposite said opening, bolts having one of their ends secured to said plate their opposite ends being secured to said plate adjacent said opening, a plurality of anchor shaped plates interposed between said casing and said first named plate, said anchor shaped plates being arranged in layers, certain of said plates having their arms arranged outwardly from stems projecting inwardly, adjacent plates having their stems projecting outwardly and their arms disposed inwardly, the next over lying layer of plates having their bodies disposed in reverse relationship with respect to the next under lying layer of plates.

9. A mixer including a casing formed with inlet and outlet openings, a mixture breaking unit arranged around one of said openings, and said unit including an imperforate plate arranged opposite said opening, bolts having one of their ends secured to said plate their opposite ends being secured to the inner face of said casing adjacent said opening, a plurality of anchor shaped plates interposed between said casing and said first named plate, said anchor shaped plates being arranged in layers, certain of said plates having arms arranged outwardly from stems projecting inwardly, adjacent plates having their stems projecting outwardly and their arms disposed inwardly, and spider shaped plates also arranged upon said bolts and interposed between certain of the layers of said anchor shaped plates.

10. A mixer, including a casing formed with inlet and outlet openings, a mixture breaking unit arranged around one of said openings, and said unit including an imperforate plate arranged opposite said opening, bolts having one of their ends secured to said plate their opposite ends being secured to the inner face of said casing adjacent said opening, a plurality of anchor shaped plates interposed between said casing and said first named plate, said anchor shaped plates being arranged in layers, certain of said plates having their arms arranged outwardly their stems projecting inwardly, adjacent plates having their stems projecting outwardly and their arms disposed inwardly, the next over lying layer of plates having their bodies disposed in reverse relationship with respect to the next under lying layer of plates, and spider shaped plates being interposed between every third and fourth layer of said anchor shaped plates.

11. A mixer including a casing formed with inlet and outlet openings and a mixer unit within said casing having a passageway for the passage of the fuel mixture of varying size or volume along the path of the flow of the mixture for alternately slowing down and speeding up the mixture stream.

12. A mixer comprising a casing, baffling means within said casing, and anchor shaped plates forming a part of said baffling means.

13. A mixer comprising a casing formed with inlet and outlet openings, a baffling means positioned within said casing and arranged adjacent one of said openings, and a plurality of anchor shaped plates, and spider plates forming a part of said baffling means.

14. A mixer comprising a casing formed with inlet and outlet openings, a baffling means positioned within said casing and arranged adjacent one of said openings, and a plurality of anchor shaped plates forming a part of said baffling means, certain of said plates having their arms extending outwardly, others of said plates having their stems extending outwardly.

15. A mixer including a casing formed with inlet and outlet openings and a baffling means comprising a plurality of spaced plates between which the mixture flows, said elements having edges free to vibrate during the flow.

16. A mixer including a baffling means, anchor-shaped plates forming a part of said baffling means, means engaging the stems of said plates for mounting the same, the ends of the anchor arms of said plates being free to vibrate.

17. A mixer including a baffling means comprising a plurality of spaced plates, said plates being so disposed as to provide spaces varying in size between their adjacent faces.

18. A mixer including a baffling means comprising a plurality of spaced plates, certain of said plates being of a shape different from each other and having their bodies so disposed as to provide a space varying in size between their adjacent faces.

19. A mixer including a baffling means comprising a plurality of plates spaced from each other, said plates being formed with cutout portions to provide openings extending longitudinal of said baffling means and transversely of said plates to provide openings within said baffling means.

20. A mixer including a baffling means comprising a plurality of plates, certain of said plates being anchor-shaped, and shoulders forming a part of the stems of said plates.

21. A mixer including a baffling means

comprising a plurality of plates, certain of said plates being anchor-shaped, and shoulders forming a part of the stems of said plates, said stems being formed with reduced portions adjacent said shoulders.

22. A mixer including a baffling means comprising a plurality of plates, certain of said plates being anchor-shaped, the stems of said plates being formed with reduced portions.

23. A mixer including a baffling means embracing a plurality of annular plates, and shoulders forming a part of said plates and extending outwardly from the edges thereof.

24. A mixer including a baffling means including a plurality of plates spaced apart and having shoulders on their edges as and for the purpose described.

CLARENCE HERBERT BENNETT.