The BESSEMER OIL ENGINES

THE BESSEMER GAS ENGINE CO.
GROVE CITY., PA.

CATALOGUE NO. 101

THE BESSEMER OIL ENGINES

TYPE IV

AWARDED
GOLD
MEDAL
at
PANAMA
PACIFIC
Exposition

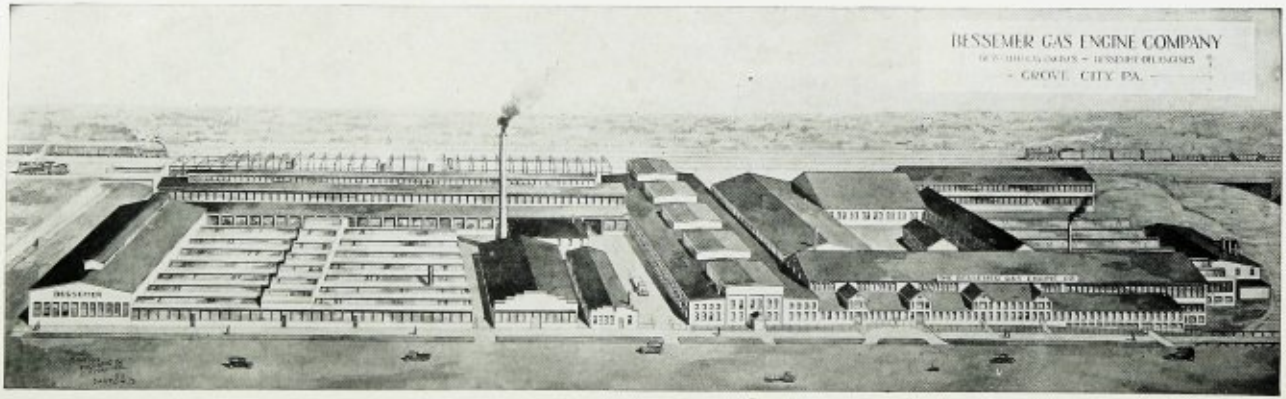
Manufactured by

The Bessemer Gas Engine Co.

Capital, $1,000,000.00

Main Office *and* Factory

Grove City, Pennsylvania



The Bessemer Plant To-day
Bessemer Engines Are Built from The Pig Iron Yard to The Completed Engine Under One Roof

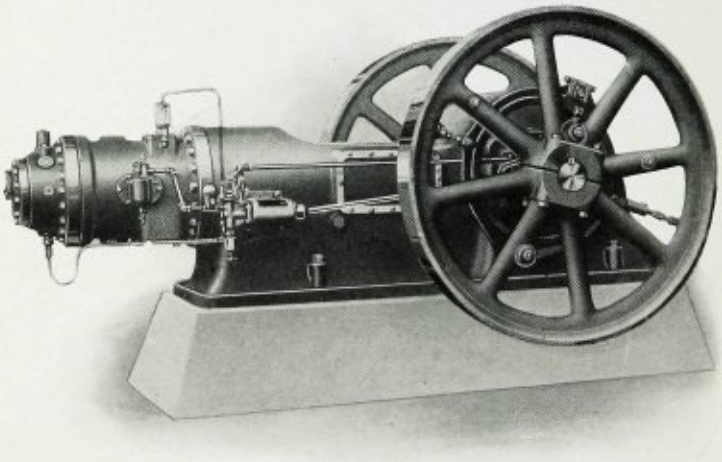
READ *not to contradict and confute, nor to believe and take for granted, nor to find talk and discourse, but to weigh and consider.*

—Lord Bacon.

With the quotation from Bacon fresh in your mind we ask your consideration of Bessemer Oil Engines. We want to go further, we want you to judge the Bessemer by the Bessemer alone as far as its past history is concerned. Do not judge the Bessemer by the history of any other oil engine with which you have been acquainted in the past. Judge the Bessemer by the Bessemer's history in the power field—and there are over twenty-six thousand Bessemer Gas and Oil Engine installations now running that you may inspect. Some of these installations are near you.

Just what does the installation of a Bessemer Oil Engine mean to you? That, to you, must be the all important question and to us it is no less important because we believe that a business transaction to be successful must be mutually profitable—that the buyer must profit from his purchase—and we have no intention, no desire to attempt to sell you a Bessemer Oil Engine except on this basis.

What does a Bessemer Oil Engine mean to you? A manufacturer was paying the central station two hundred and fifty dollars a month for current, a Bessemer produced the same current at a fuel cost of less than forty dollars! An ice manufacturer by means of a Bessemer Oil Engine produces ice at a fuel cost of thirty-four cents per ton! A cotton ginner who had been ginning cotton at a cost of seventy-five cents per bale replaced his steam plant with a Bessemer Oil Engine and the fuel cost per bale became twelve cents! A rancher pumps 2,160,000 gallons of water



Type IV Bessemer Oil Engine
Single Cylinder, Governor Side

for irrigation in twenty-four hours at a fuel cost of $1.26—just one eighteenth the cost of electricity in his district! These are examples of what others have saved by installing Bessemers. As to whether a Bessemer Oil Engine would mean a similar saving to you, we can determine before you spend one cent for its purchase. There is no guess work about it. Guarantees (and Bessemer guarantees are good) replace promises.

As a power user you are given the choice of various means of securing that power. You may install a steam plant, you may purchase electricity from the electric companies (commonly known as "the central station") or you may use a gasoline engine or a gas engine running on manufactured or natural gas, or you may use a Bessemer Oil Engine. Proceeding on the basis that our sales must be mutually beneficial and profitable, our advice, if requested, will be fair to all types of power. If you use steam in your manufacturing processes there might be instances in which steam would be the most profitable; if the electric company will furnish current at say three-quarter cents per kilowatt hour without any fixed

charges, perhaps it would be advantageous to use purchased electricity. The use of manufactured gas or gasoline could not be profitable, in comparison with the Bessemer Oil Engine, under any conditions known to us except in light, high speed, portable engines with which the Bessemer Oil Engine does not compete. We refer to automobiles, aeroplanes, etc.

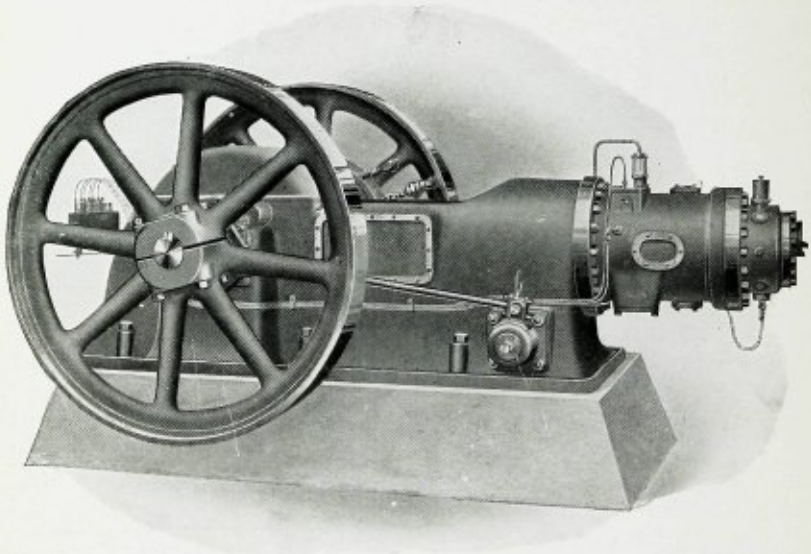
To give you an idea of the cost of various forms of power this table will be interesting. The prices given are average prices and this must be taken into consideration in reading it. Perhaps in your district coal is more costly than we have listed it and oil may be cheaper. But to the next man who receives this catalog the reverse may be true. You may ask any consulting engineer as to the fairness of this comparison.

Cost of Fuel 100 H. P. 10 Hours:	
Steam Engine 6 lbs. coal at $3.50 per ton and 10 per cent standby loss	$11.55
Gas Engine 17,000 feet at $1.00 per M (Manufactured Gas)	17.00
Electricity from Central Station 750 K. W. at 3 cents	22.50
Gas Engine (Natural Gas) 12,500 feet at 30 cents	3.75
Bessemer Oil Engines .7 pt. per H. P. per hour at 4 cents per gallon	3.50

The saving over steam is of course not represented by fuel alone but also in the fact that no licensed engineer is required, no fireman, a pipe instead of an expensive stack, no grate bar or boiler tube expense, no shut down for inspection or inspection fee, no ash disposal and a number of other items that makes the difference in your power cost much more than is represented by the fuel alone.

Does this comparison, Mr. Power User, carry any message to you? Remember that this saving is shown for but ten hours—figure it out for 3,000 hours or a year's run. Then for ten years. On the oil engine-steam engine comparison there would be a saving of $24,150. Then you likely use more than 100 H. P. You may run more than 10 hours a day. Let us treat your particular case by permitting us to know your present power costs.

Natural gas is found in such restricted area that it is only a favored few that have access to this best of fuels. But cheap fuel oils and crude



Type IV Bessemer Oil Engine
Single Cylinder, Valve Side

oils of the grades used in Bessemer Oil Engines are universal. There is no corner in the United States—of North or South America, of Europe, Asia, Africa, the islands of the sea—where power is used, that oil is not available. In our own country the irrigation field and mining sections are especially favored, and, as a rule, where coal and wood are costly, oil is cheap, abundant and easily transported.

You will grant that the comparison of fuel costs is fair to all forms of power. You will grant that a Bessemer Oil Engine is the most economical means of power available—that the installation of a Bessemer will be a money-making investment for you.

And then the question of reliability arises.

Fifteen—twenty years ago you could have raised the question, you might have been justified in hesitating—but now, if you choose a Bessemer, you buy without risk, without risk as to engine or the engine's

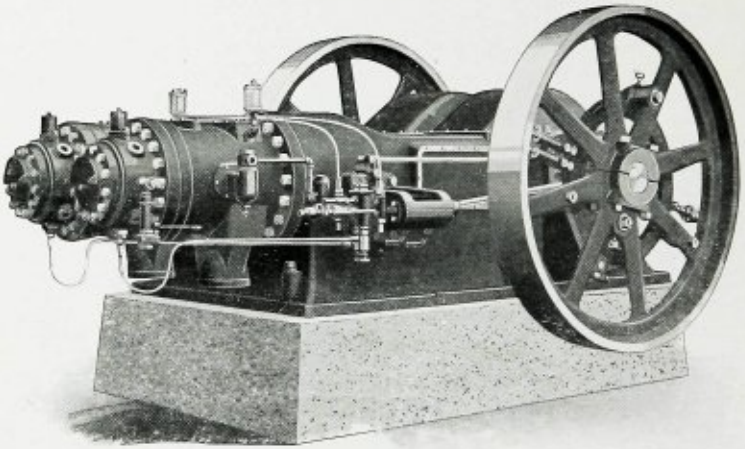
service. Bessemers are tried engines, tried and proven in installations demanding the most exacting service. And it is here again that we ask you to judge Bessemers only by Bessemers—and not by any other engine. We will gladly refer you to any number of concerns in the same industry as that in which you are engaged, who will tell you of the reliability and dependability of Bessemers. In choosing a Bessemer you secure the benefit of experience—you are not made a partner in experiments.

Claiming that an engine is reliable does not necessarily make it so. But if that claim is made by a company who, since before the century opened, have backed every claim, have made good every claim, as has the Bessemer, you are safe in accepting the statement. But we have referred above to users of Bessemers. They are disinterested. Ask them. We offer their testimony.

There are good reasons for Bessemer Oil Engine reliability. The great weight and strength of the engine, the simplicity, the few parts to keep in normal relation, the wide adjustment for wear, the guarding of the quality of the materials that enter into Bessemers, the system of inspection and of testing, the maintenance of our own metallurgical laboratory and the fact that the engine is built from pig iron to shipping room under one roof, all contribute to Bessemer reliability.

In Bessemers you have economy, reliability, dependability and you have real simplicity. You who have studied contemporaneous oil engine construction know, and you who are investigating oil engines will find, two widely separated types. Is it not so? One economical in the use of fuel, but a maze of complicated parts surely difficult to keep in their normal relation, surely requiring an attendant of extraordinary knowledge and training, surely expensive in upkeep. The opposite type is uncomplicated in construction, but wasteful in fuel and built to sell on a price appeal only.

In Bessemers, mechanical simplicity and true economy are combined at their best. In them you find a simplicity that enables one unversed in mechanical knowledge to secure the best results. The functions of the comparatively few parts are readily understood. Bessemer Oil Engines are installed out on "the edge of things"—far from any expert attention



Type IV Bessemer Oil Engine
Twin Cylinder, Governor Side

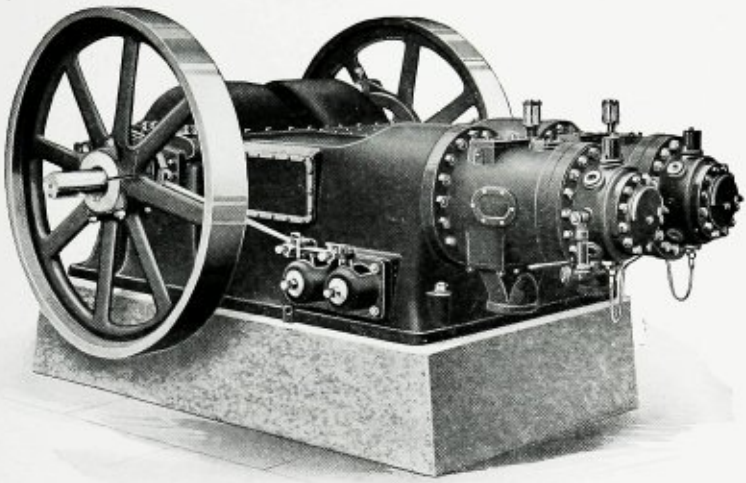
or source of aid—and they go about their work every hour in the twenty-four if it is desired. Economy that is *true* economy—that takes into consideration not alone the fuel consumption, but also grade of attention required and upkeep expense. The Bessemer will give you year round economy that no other engine can possibly approach.

Back of this economy, reliability and simplicity are the Bessemer guarantees.

The claims for reliability, economy and simplicity have been made by us. They are also made by others asking for your order. We only want you to compare the Bessemer with any or every other oil engine offered you as fulfilling these claims—and we are content to let the decision as to which engine you shall choose to be installed in *your* plant entirely in your hands, believing that you, too, will choose the Bessemer.

Did the engine not excel in these features you should choose the Bessemer on account of its superior construction.

A glance at a picture of the Bessemer Oil Engine will impress you with the heavy, massive construction used. Not weight for weight's sake

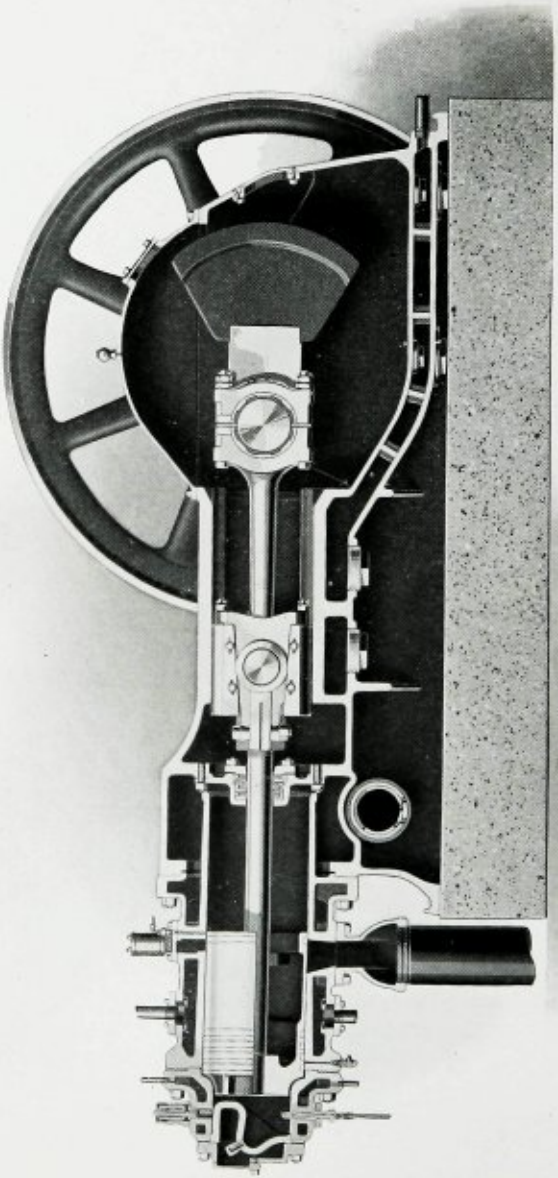


Type IV Bessemer Oil Engine
Twin Cylinder, Valve Side

only, but weight properly distributed to make strength and durability. Here in addition to strength is neatness and symmetrical lines. An engine that is at home in the white tiled engine room—an engine in which you can feel a pardonable pride and one that from its very beauty will compel attention. With the crank case entirely enclosed the wearing parts are kept free from dust or dirt.

You will find this catalog free from meaningless adjectives. It may come to you along with other catalogs in which "best," "simplest," "most economical," etc., are common. We suggest comparison. There are no claims made herein but what are substantiated and reasons given therefor. Back of our claims and guarantees is a financial responsibility that the commercial agencies or your banker will assure you is sound. But beyond this financial responsibility we feel a moral responsibility that causes us to try to give you more than full value, to take a continued interest in your installation, to see that you secure the wonderful results you were led to expect when you made your purchase.

We will now treat at length of the parts that enter into the complete engine, the wide adjustment for wear and many exclusive features.



Sectional View Type IV Bessemer Oil Engine

Description

REFERENCE to the sectional cut will show that the cylinder is in a sense double acting. The crank end of the cylinder is used as an air pump which furnishes the air necessary for combustion of the oil. Into this crank end of the cylinder, during the head stroke of the piston, air is drawn through the valve at the bottom, filling the evacuated space at atmospheric pressure. During the crank end stroke of the piston, this air is compressed slightly (to about 5 lbs. per sq. in.) and immediately upon the uncovering of the inlet port in the upper side of the cylinder by the piston this compressed air rushes over to the head end of the cylinder, sweeping before it and out of the exhaust ports at the bottom of the cylinder the burned products of the previous charge. Upon the following head end stroke this fresh charge is compressed in the combustion end of the cylinder while a new charge is being drawn in at the crank end of the cylinder. Near the dead center a pump injects fuel into the combustion chamber, which is ignited by contact with the hot surface of the ignition bonnet in the head and upon burning produces a rise in pressure, which drives the piston outward upon its power stroke. The ignition bonnet is heated by means of a gas or kerosene torch for a few minutes before starting, after which the combustion supplies the necessary heat for ignition.

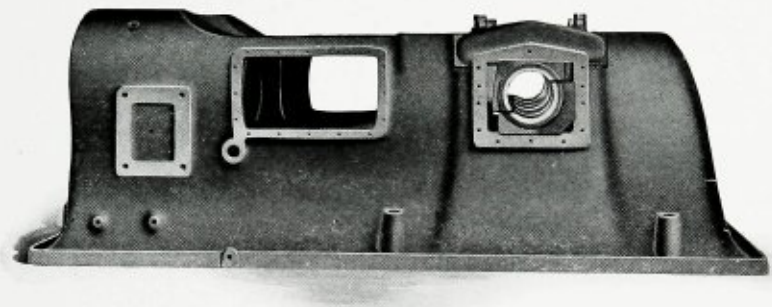
Our patented combustion chamber is novel in form and we believe the only rational one for this type of engine. The fuel is injected in a finely atomized state from the bottom in an upward direction in order that the fuel may not only seek its oxygen for combustion in passing through the air charge as a result of injection but that the unconsumed portions of the fuel, carbon, etc., have no other course than to shower downward again through the rapidly agitated and burning gases below and be consumed. The fuel is given no opportunity to cake and carbonize on red hot metal.

At the time of injection all of the air charge is massed directly before the injector, in which position it cannot fail to mix effectively with the entering oil, as it is gasified.

The form of the combustion chamber is vital to the economical operation of any oil engine. The combustion chamber in the Bessemer Oil Engine is a radical departure from the hot ball and spoon (or lip) arrangement, which is fully twenty years old, and still found in several other makes of engines now on the market. The only excuse for the existence of such an arrangement is that it works, regardless of the results produced. We have indicated premature explosions from this hot ball construction ranging as high as 800 lbs. per sq. in. Frequently such explosions wreck an engine, when the water feed is shut off. With the Bessemer hot bonnet construction we get a lower maximum pressure with the water feed shut off, thus proving that we use water vapor to control temperatures and to aid combustion rather than kill prematures.

The feature which has been responsible for the success of the Bessemer hot bonnet oil engine is the fact that there are no uncertainties about starting. A successful start depends on two things—knowledge that the pump is working properly, which is easily determined by operating the pump by hand, and correct heat of the ignition bonnet. The state of either of these two important parts can be determined by the eye and almost without any experience. This is not true of engines employing carburetors and electric ignition devices. Whether or not an engine of this latter type is adjusted for the proper starting mixture can be determined only by repeated trials unless the engine is in the hands of an experienced operator. Even these men sometimes find difficulty in making the necessary adjustments, as changes in the quality of liquid fuel, or changes in atmospheric temperature, are all important factors in the successful operation of the carburetor type of engine. By dispensing with electric ignition apparatus, we have also dispensed with another source of annoyance and expense. Possibly nine-tenths of the engine troubles which result in the calling for an expert may be traced to ignition apparatus, and experience has shown that at best this apparatus is costly in up-keep. There is no mixture setting to be made on the Bessemer Oil Engine and no ignition timing to require frequent adjustment. The state of the fuel pump and governor determines these things and they are set and keyed at the factory and are alike for all fuels.

The Main Frame or Bed Plate



Type IV Bessemer Oil Engine Bed Plate
Showing Removable and Adjustable Main Bearings

In designing this bed plate particular attention was given to the distribution of metal. Its depth is such that at what is commonly termed the dangerous sections, an unusually high factor of safety is secured. The thickness of the casting was not determined by the actual stresses but by the requirements of the foundry, that is, in other words, the form of this bed gives it an inherent rigidity so great that it would be amply strong to resist the strains imposed upon it were the metal but half as thick, the thicker metal being necessary in order that the moulder may successfully produce the casting. Nor is this added weight lost, as there is much of the anvil principle built into this design, resulting in a bed plate free from tremors and deflection in any of its members.

The larger sizes of these beds are equipped with a water jacket under the crank pit. While this is not altogether necessary under all conditions, we find it to be a valuable feature in the South, the Southwest and the Tropics, where, during the summer, engine rooms are very hot, and especially valuable when engines operate under practically continuous service. There is a certain amount of friction loss in all bearings, no matter how perfectly they may be lubricated. This friction loss is dissipated as heat which must be radiated to the atmosphere.

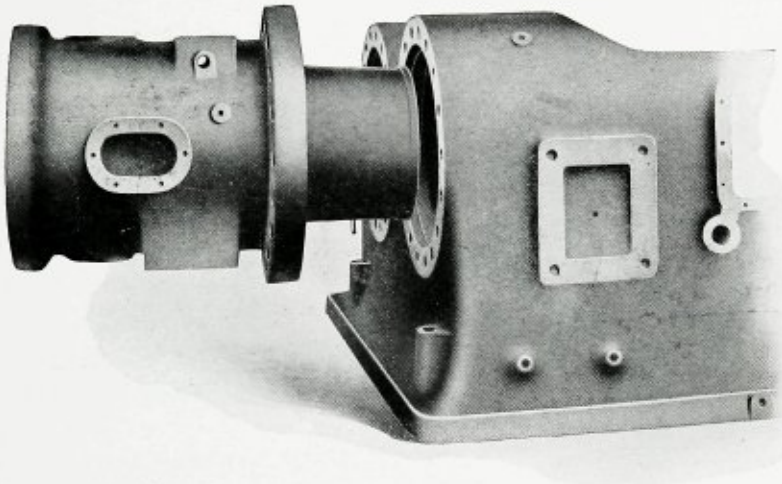
In the designing of bearings, engineers consider the form of housing and the opportunities for convection and radiation of this heat to the surrounding atmosphere. In fact, under similar loading conditions these two apparently foreign matters will determine the relative sizes of bearings. It will readily be understood that an engine operating at full or overload 24 hours per day in a closed engine room at a temperature of 115 degrees Fahr. will have less opportunity of radiating its friction heat than one operating in the open air or in a colder climate. Locomotive design bears witness to this, for in locomotive construction designers find it possible to use far smaller bearings than it would be possible to employ on enclosed stationary engines for the reason that the motion of the locomotive itself through the air aids in the dissipation of the heat generated. It will then be evident that we can, by jacketing this crank pit and withdrawing the heat from the oil as fast as it is taken up from the bearings, produce an operating condition which will be practically constant, regardless of season, climate, location or operating conditions. At the same time this need not necessarily increase the water consumption of the engine, as the water from the oil cooling jacket passes on through the cylinder jackets, being heated very little during the first part of its travel.

Aside from the features of this bed which are embodied in the design, our shop practice in producing the actual casting and in finishing it is equally important and calls into play the best efforts of our foundry and shop organization, backed by a large investment in machinery and equipment of the best possible description for this class of work. The cores for even the largest of these castings are baked in iron boxes, a method which, while requiring far more costly equipment than the old way of sand bedding, results in perfect uniformity of metal thickness throughout the casting, as no warped cores are produced. The casting itself is molded in a heavy iron flask—the only sure way of producing castings without swell or strain. The machining of the bearing jaws and all flat surfaces is completed at one setting on a ponderous four-head milling machine. Upon completion of these operations the guides are bored and the cylinder flange faced at one setting. This latter machine carries two bars by means of which twin beds may be bored in perfect alignment at a single setting.

There is optical evidence sufficient in viewing the heavily buttressed crank end, the solid cylindrical form of the cylinder end and the extra

strength afforded by the lugs on the bearing caps tying in the main bearing jaws, which are usually regarded as the danger section, to convince one that this engine member is really of the heavy duty type.

Possessing, as we do, our own foundry and our own complete metallurgical laboratory, we are enabled to closely guard against improper cylinder castings. The cylinders of Bessemer engines are cast from a



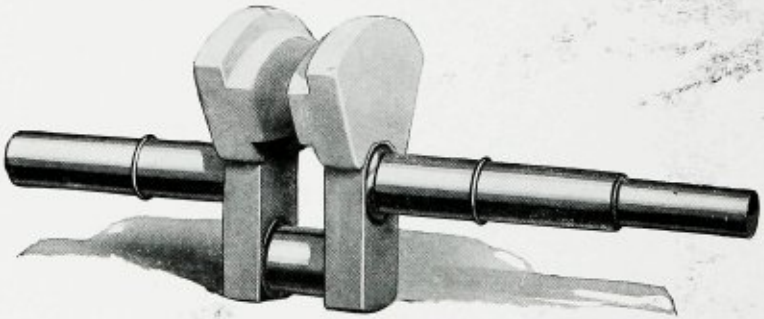
The Cylinder

special formula, using close-grained grey iron, of a slow machining quality, to which is added a proportion of steel, which further fills the interstices and toughens the castings. The formula, grades of iron and process used in casting are almost identical with that used in making locomotive cylinders, the highest grade, highest priced steam cylinder castings made.

The cylinders are of great weight. In them you will find several times the necessary computed strength. Everyone is tested by hydraulic pressure after machining and must show perfect before being passed into service. There are no offsets or projections in the cylinders, hence no undue strain due to variable temperatures to which the cylinders are subjected. The cylinder is thoroughly water-jacketed, as are also the exhaust ports, and the exhaust port bridges.

The overhung cylinder offers many advantages in construction and in convenience of installation, piping, etc. However, engineers have objected to this construction on account of the deflection often noted in operation. This objection has been entirely removed by the Bessemer construction. The cylinder is secured to the bed by means of a flange at almost mid-length, thus greatly reducing the overhang. Deflection is also prevented by the use of the crosshead which throws all transverse strains against guides carried in the bed instead of against cylinder walls, as in the trunk piston design.

Bessemer Crank Shaft



Bessemer Oil Engine Single Throw Crank Shaft

In proportioning a crank shaft it may be said that to a certain extent its final weight and dimensions depend upon the designer's view of the proper length for the bearings. Strength considerations dictate that the centers of the main bearings shall be as close together as possible. Successful bearing practice requires long bearings. Yet long bearings must be sufficiently rigid or otherwise their deflection under load may be such that only a small portion of their apparently useful length is utilized in supporting the load at the time of greatest pressure. Thus of two crank shafts with bearings of different dimensions but the same projected area, the shaft having the longest bearings runs the cooler, if it is sufficiently rigid. On the other hand, in order to attain this same rigidity, it is neces-

sary to keep all bearings as short as possible. These two conflicting conditions call for considerable care and judgment in designing a shaft, and in the larger engines, if durability is the first object rather than cost, comparatively long bearings will be provided, especially at the crank pin, at the necessity of increasing the crank pin diameter and the crank arm section sufficiently to obtain a rigid shaft even with this added length or span between main bearing centers. This will result in larger crank pin box and connecting rod and broader and deeper bed to clear these parts.

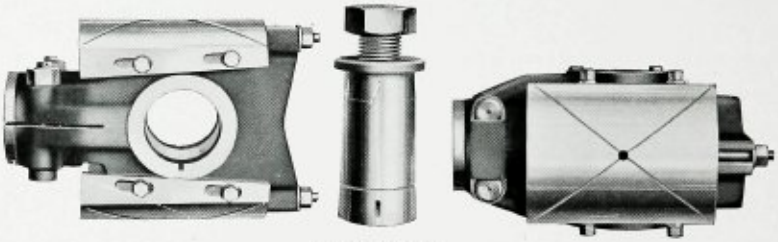
The life of the shaft is dependent upon four factors—kind and regularity of lubrication, quality of material and the stress to which it is subject. The first of these conditions is fulfilled by our system of oil bath ubrication. This is a system which has its friends and few opponents. We recommend it with utmost confidence for the reason that in our experience we have had practically absolute freedom from excessive shaft wear or badly scored bearings with this type of engine. This is most certainly not the usual state of affairs encountered in manufacturing engines dependent upon gravity lubrication of these parts, as a moment's carelessness may, and only too often does, result in complete ruin of the crank shaft and its bearings from lack of oil.

Bessemer shafts are forged from a solid billet of .30 to .40 carbon open hearth steel, a material which is recognized as a standard for high-class work in stationary engines, and in designing these shafts comparatively low stresses are used, insuring a high factor of safety and freedom from breakage.

The Bessemer Twin Cylinder Oil Engine has the crank pins 180° apart. Two impulses every revolution with a perfect balancing of the engine are thus obtained. Compare the perfect balancing obtained in the Bessemer twin cylinder engine with that of other makes.

Very few makes of engines equal the Bessemer in diameter of crank shaft used per horse-power transmitted, but you will find the diameter of crank and crank pin and the width of the slabs or bell crank shaft to be greater on the Bessemer than on any other engine of the same horse-power. This is typical of Bessemer construction throughout.

The Bessemer Crosshead



The Crosshead

The worth, in fact the real necessity, of employing the crosshead in internal combustion engines is well expressed by Dr. Poehlmann, Construction Engineer at the Royal Technical Institute, as follows:

"It has often been urged through the technical literature that there are no good grounds for making the working piston of a large internal combustion engine serve as a crosshead, as is done with great success with small motors. In the case of the latter, considerations of cheapness and simplicity play the greatest role. The durability of single details of construction is a secondary matter. The wear of the pistons and cylinders of these small motors is so little that no noteworthy failures result from the practice. The circumstances are altered in the case of large engines. The pistons require here, when they must also take the guide thrust, large dimensions and the most painstaking fitting. The surfaces which must be lubricated are exceedingly large and call for an unusually great expenditure of cylinder oil. The wear of the cylinder walls and the piston body is, in consequence of the great side pressure, serious, and proceeds at a measurable rate, and in consequence of the lack of adjustment, these large trunk pistons bump and knock as they travel in the cylinder bore. A further weighty disadvantage of the engine without the crosshead must be considered; that is that the wrist pin is built into the hot piston, whereby the radiation of its friction heat is made difficult. In consequence of the high temperature, the lubricant loses its viscosity to such a great extent that it becomes practically valueless."

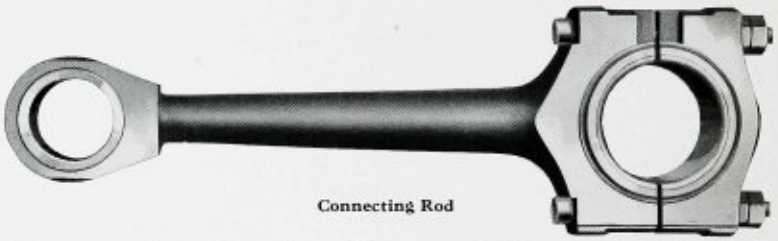
A further disadvantage of the trunk piston engine is that a large portion of the harmful heat arising from the piston and wrist pin is transmitted through the connecting rod to the crank pin and crank shaft bearings.

It is worthy of note that the first Diesel engines were built with crossheads and that although the firm which produced these engines is out of business for a decade, their engines are still running and have shown themselves to be durable machines. We may add that it is sometimes urged that the crosshead increases the weight of the reciprocating parts to a harmful extent. This argument does not apply to the two-cycle engines, as this weight is cushioned at each head center by the comparatively high compression employed and its effect in producing a uniform turning effort is most noteworthy. The idea that heavy reciprocating parts are sometimes desirable was first advanced by Chas. Porter, the pioneer high-speed engine builder. Although Porter did not complete our theories of reciprocating motion alone, he was instrumental in bringing about a solution, and by means of the analysis thus originated was able to demonstrate to the engineering world that reciprocating parts in being accelerated from the dead center position to the quarter position absorb energy at the time when the pressures in the cylinder are at a maximum, and that this energy is again given up to the crank pin in completing the stroke at the time when the pressure in the cylinder has fallen appreciably, due to expansion. The effect of this is to produce a more uniform effort at the crank pin, with the result that lighter flywheels can be employed, or with a given weight of flywheel an engine better suited to electric drive will result.

Neglecting all these other advantages, possibly one of the most weighty reasons for employing a crosshead in the two-cycle design is that by its use compression in the crank case may be avoided. It is practically impossible to design a set of crank shaft bearings which must necessarily be split to admit the shaft and to provide a satisfactory means of adjustment and at the same time to make the same bearing air tight. Comparatively satisfactory devices for accomplishing this result have been in use for some years for small engines, but they all involve the necessity of spreading the main bearing centers to admit their use, which greatly increases the bending stress on the crank shaft.

The phosphor bronze shoes on the crosshead illustrated are fitted to the crosshead on a 4° taper, permitting of adjustment for wear for many years. The crosshead is steel and fitted with a tool steel wrist pin, hardened and ground. The wrist pin is removable.

The Bessemer Connecting Rod



Connecting Rod

Our connecting rods are forged from a solid billet of open hearth steel of Class A Government specifications. The ends are bored in a horizontal boring machine at one setting, insuring absolute parallelism. That the small end is not provided with adjustment will meet with the approval of all men who have had experience with machinery of this type. By dispensing with this adjustment we are enabled to incorporate a much larger pin with more generous bearing surface than would be otherwise possible. The life of the bearing is thus greatly increased. Experience has long proven that the wedge adjustment for internal combustion engine rods is worthless, and any one who has been required to refit split bearings at this point will agree with us that it is a far simpler and less costly proposition to renew a bushing. Many connecting rod failures are caused by a breakage of the bolts in the small end of the rod, it being very often impossible to provide bolts at this point with an ample factor of safety on account of space limitations. We believe these arguments in themselves will convince the engineer that we have followed best practice in building this rod with a solid eye at the crosshead end, and to the layman we offer as an example the locomotive, the only parted box provided on locomotive rods being that on the large end of the main driving rod, which is necessary for assembling, and this is "jointed up metal to metal."

The crank pin end of the connecting rod is provided with a split shell of bronze lined with genuine babbitt. This shell is machined both inside and out, the inside being heated and tinned before the babbitt is poured, thus fluxing the babbitt to the bronze and securing a perfect union between the two metals, in addition to which dovetail babbitt anchorages are provided in the bronze. This is a construction largely used for locomotive and car brasses and marine work. The only reason that it is not followed in general practice is on account of the expense of production. Its use in railroad and steamship service is sufficient proof of its efficiency.

Bessemer Piston Heads

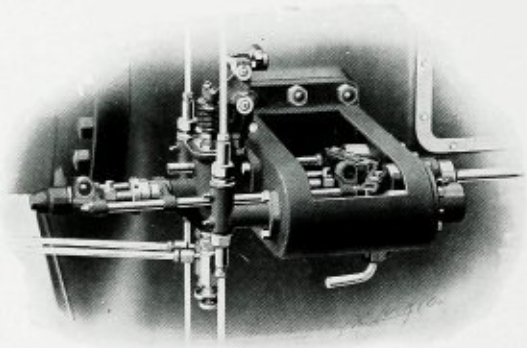
The Bessemer Piston Head has in length a wearing surface exceeding the stroke of the engine. This long wearing surface, with the absence of the up and down connecting rod thrust, so hard on the four-stroke cycle cylinder and piston head, makes the Bessemer an engine which gives continuous service and has long life.

As in all other parts of the Bessemer Oil Engine, special care is taken that in the casting of the piston head a fine, close-grained iron is used.

The finished surface is highly polished, and limit gauges are used to insure duplication. A reduction in size is made at power end which exactly conforms to the expansion of the material used due to the higher temperature at that point.

The life of Bessemer pistons, as stated above, is, like the life of Bessemer cylinders, very long. On account of our construction and the use of the crosshead, the piston bears on the cylinder with only its own weight. This is in direct contrast to the trunk piston of the four-stroke cycle engine, which bears on the cylinder not only with the piston's own weight, but also with the down thrust which is produced by the angularity of connecting rod on power stroke. You will understand the longer-wearing argument which we advance, when we state that the amount of pressure per square inch of projected area will not exceed one and one-half pounds.

The Bessemer Fuel Pump and Governor



The Bessemer Twin Engine Fuel Pump

Upon governing and fuel pump equipment we spend more money than any other firm in the field. The results obtained in the way of regulation and economy repay this investment a hundred fold. Not only is the fuel pump under governor control but the water feed pump has mechanical control which is altogether automatic, as well as a manual adjustment for setting the water to oil ratio to suit any sort of fuel. Twin engines are fitted with individual automatic water control for each cylinder.

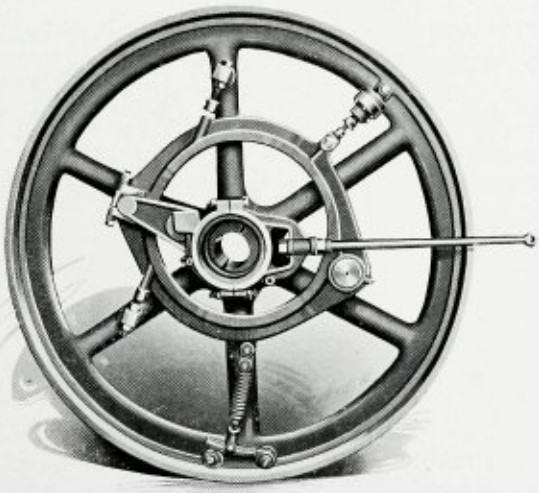
The Governor

The governor is of the inertia type which came into prominence in steam engine work. The ring which surrounds the hub forms the governor weight. It is pivoted at one point in the circumference, and its controlling power is due to two different forces which act simultaneously when a change of speed occurs. Due to its inertia this ring tends to overtake the wheel should the latter slow down or lag behind in case of reduction of engine speed. In addition to this, the center of gravity of the ring being off center, the centrifugal force acts as usual to assist in moving the governor weight to the proper position as required by the load and to maintain that position until further change of load, once it is acquired. The eccentric sheave is carried upon an arm which is pivoted at the wheel hub and attached to the governor weight opposite to its point of sus-

pension by a small crosshead. Thus an outward movement of the governor weight due to a rise in speed moves the eccentric sheave inward, shortening the pump stroke, and vice versa. The weights of the governor parts are so arranged that the eccentric sheave, strap and rotating part of the rod counterbalance the governor weight in any position, thus obviating any tendency for the governor to fall from its true position twice per revolution, as will occur when a governor lacks "gravity balance." Change of speed can be made by sliding the spring clamp along the segment in the wheel rim. By making speed changes in this manner we are able to get equally good governing and an equal sensitiveness or degree of speed variation throughout the speed range. It is impossible to accomplish this object in any other manner.

All pins are hardened and ground and of very liberal dimensions. The governor eccentric is a high-grade O. H. Steel casting and the strap of bronze. The weight pin and the suspension pin bores are bronze bushed and springs are bought to specification.

The action of this governor is neither so rapid as to cause difficulty in parallel electric operation, nor so sluggish as to cause undue fluctuation



The Bessemer Governor

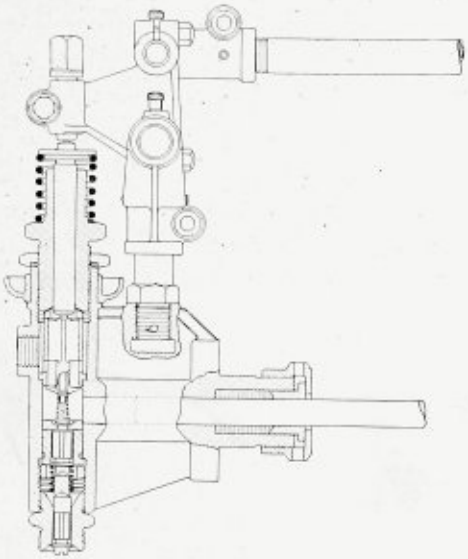
when a sudden change of load occurs. Internal friction has been reduced to a minimum by freeing the pins of reaction as far as possible. Therefore, "hunting" never occurs with this governor. Dangerous hammering so often heard in starting or shutting down an engine fitted with a shaft governor is unheard of with this design.

The functions of the fuel pump of an oil engine are so interlinked with those of the governor and with the processes which take place inside of the combustion chamber, that good regulation is not entirely a matter of a good governor. A regulator which is mechanically and technically perfect will be almost as utterly useless as the most imperfect one if the fuel pump fails to deliver a perfectly measured charge each cycle, or if upon delivery to the combustion chamber the perfectly measured charges are not so burned as to generate equal power impulses for any given load.

As an instance of this the full load oil charge for a 40 H. P. Bessemer is approximately .06 cu. in. per cycle. Should the pump, due to irregular valve action, deliver but .01 cu. in. less than .06 cu. in. at a time when the engine was driving a steady 40 H. P. load, the following power impulse would be sufficient only to maintain the rated speed under a load of approximately 33 H. P., calling for a considerable loss of flywheel energy, which is necessarily accompanied by a proportionate drop of speed.

A good governor would immediately respond to this condition and the following charge would be enough greater than the normal one to make up for the loss during the previous cycle; but needless to say, if a given position of the governor, as determined by a given speed and load, does not correspond to some constant and proportional charge of oil due to irregularity of the pump, the governor will be in a state of constant motion to an abnormal extent and its regulation cannot be other than poor. The functions of the governor are corrective only. It cannot anticipate any of those phenomena which would exert an influence in altering its position, and it should not be taxed with the duty of averaging abnormal variations in pump action in addition to its true mission of maintaining the oil charge in proper proportion to the load. It is well known that a very slight amount of governor trepidation is necessary to good regulation, but engineers prefer to allow this to take place as a consequence of other influences more constant in force and permitting of more accurate control than any such evil as irregularity in fuel pump action.

Bessemer Oil Engine Fuel Pump



Sectional View Bessemer Fuel Pump

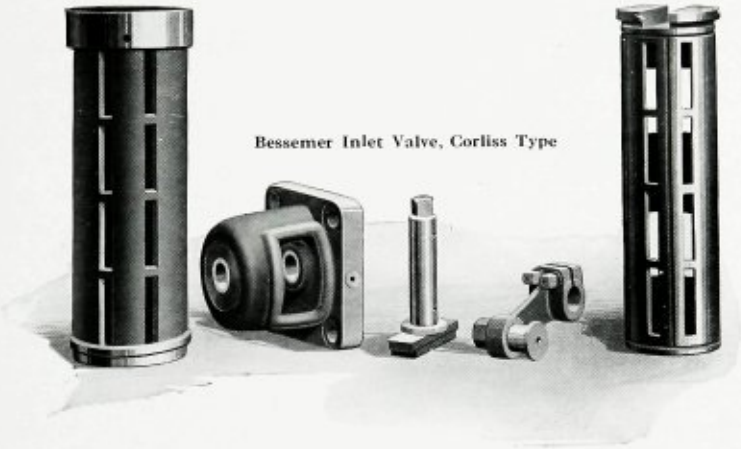
The action of the fuel pump shown above is as follows: During the outstroke of the horizontal plunger the suction valve opening into the top of the pump chamber is held open by its operating cam through the rod and bell crank shown at the top of the pump, the cam itself being mounted on the crank shaft. During this time an excess charge of oil is drawn into the cylinder. As the pump eccentric reaches its dead center and starts the plunger on the instroke, the suction valve is still held open and oil is by-passed back into the air chamber (not shown) on the suction pipe. Just 6 to 8 degrees before midstroke the cam presents a flat surface to the roller which takes off the motion, allowing a very rapid closure of the suction valve, while the continued advance of the plunger forces the lower or discharge valve open, delivering oil to the combustion chamber for a period of 12 to 16 degrees, which is terminated by the re-opening of the upper valve by the cam motion again allowing the oil to by-pass. By this means the evils of short stroke and air troubles are

avoided, and by the use of a cam-controlled injection period the timing of injection is determined independent of the governor action. This latter feature is one which is often sacrificed, as it is difficult to so design a shaft governor that in the performance of its functions of shortening the pump stroke, it does not at the same time alter the fuel injection timing in an unfavorable sense.

A desire to build for service is expressed in the design of this pump to an unusual degree. Clamped joints are used in securing all parts which may at any time call for dismantling. This involves two extra machining operations for which we are rewarded by the knowledge that whatever is assembled will be permanent, and that at the same time any part may be removed without the use of destructive force. Valves are hardened and ground and provided with steel seats so constructed that both seating and guiding surfaces are machined in one operation. Either or both may be replaced at trifling cost and with practically no labor. Either may be removed for inspection or grinding in a twinkling. All pins are hardened and ground to a perfect finish and the plungers are treated likewise.

Those surfaces of the pump which come in contact with the oil are fully machined, while the outside surface of the bronze body is given an acid bath to remove any scale which might loosen in operation and prove destructive to wearing parts. All oil holes are provided with neat covers with automatically closing lids. In place in its housing, this pump is a most complete unit, being unusually well guided and rigid. It is the best that we can build, and with the idea that the injection system must, regardless of the type or size of engine, meet with our ideal, we apply this same pump to our O. D. engines as well as to our more costly model. It is built most thoroughly, not only for long life, but to insure the purchaser that it will not be necessary to make adjustments, correcting for wear, at frequent intervals. It is our intention that the adjustments made by our own men when the engines are under test shall be preserved, as there is little likelihood that the novice will be able to improve them. To this end even the suction valve cam roller, itself hardened and ground, is carried on a pair of large Hess-Bright ball bearings which neither allow of nor require adjustment.

The Bessemer Inlet Valve



Bessemer Inlet Valve, Corliss Type

For various reasons we have incorporated the Corliss type engine valve into our Type IV design.

The Corliss valve is far better suited to the conditions of this design than the poppet construction. A poppet valve as usually designed remains closed for a large portion of the crank travel and is then opened to admit fresh air charge. The valve must be slowly accelerated from the state of rest to full lift and closed slowly to avoid hammering on the seat. The Corliss valve opens at the time when it is moving most rapidly, that is at about the center of the eccentric stroke. It closes in the same fashion, thus providing ample opening at all parts of the stroke without danger of hammering, as there are no seats. We have improved the Corliss practice somewhat in designing this detail by providing a loose sleeve for the valve to work in. The valve is double ported and just enough unbalanced by balance ports in the upper side to insure seating without excessive friction.

The tee head on the valve stem allows the valve to freely follow the natural wear. The valve proper is served by a force feed lubricator. The stem is hollow and is lubricated by a compression grease cup. The valve itself is ground on its working surface and all pins are both hardened and ground. The rockers are open hearth steel castings and the bonnet is bushed with bronze.

Regulation

The two-stroke cycle Bessemer gives you the continuous output of power so necessary for electrical service, flour mill work, weaving and other industries requiring the most exacting regulation. The efficient inertia type of governor reduces the speed variation so that Bessemers may be used for any power requirement, no matter how exacting it may be. We are able to reduce the variation to zero, but in our opinion, stable governing is best accomplished with a moderate degree of speed variation, and thus make our standard guarantee two per cent from normal.

The matter of angular variation is considered when operating alternators in parallel in order that the change of speed during each revolution or cycle shall not be great enough to cause the generators to fall out of step. This is accomplished in a most satisfactory manner. This includes the single cylinder Bessemers, which may be chosen to operate alternators in parallel—a striking contrast to the multiplicity of cylinders and parts used in the average internal combustion engine.

Horse-power

Bessemer Oil Engines are built in single cylinder type to 85 H. P. and in twin cylinder type to 180 H. P. They are guaranteed to develop their full rated horse-power at the shaft, and there is an overload capacity sufficient to handle and overcome the heavy starting torque of high-speed machinery or motors or for an occasional peak load, such as sometimes occurs in wood working plants. They will overcome certain losses due to high elevations, but in choosing any engine it is advisable to allow for the standard corrections for elevations. Bessemers are tested at 1250 feet above sea level.

Fuels

The Bessemer Oil Engine burns the crude and fuel oils so readily secured anywhere. Some fuel oils have been given localized names such as "gas oil," "solar oil," "tops," "bottoms," etc., but in almost every case they come within our fuel specifications. Suitable oils are secured on the

western coast of the United States as low as sixty cents per barrel, or less than two cents per gallon at the refinery, and the prices elsewhere in the United States are remarkably cheap. Bessemer Engines will, of course, use gasoline, kerosene and distillates, but these fuels are usually higher in price and produce no better results. A fuel oil of 24° to 28° Baume we consider best adapted. Alcohol, which is an economical purchase in some parts of the world, is a suitable fuel.

We have tested fuels from all corners of the country, noting their behavior in both laboratory and engine tests, and upon this experience have based a specification for a fuel which will allow of continued operation without causing troublesome deposits or difficulty in pumping. Our experiences have dictated the following specifications:—

Flash—below 275° Fahr. Open Cup.
Baume Gravity—not below 24°.
Sulphur—less than ½%.
Water less than ½%.
Coke—not over 3%.
Fraction which will distill off below 360° C. at least 60%.

Gravity

In the majority of specifications for internal combustion engine fuels, gravity is omitted. We find it to be of little value as a criterion of the utility of a petroleum fuel, but as it is possibly the only characteristic with which the engine purchaser feels at all familiar, we are obliged to include it in the specifications, and have placed the lower value at 24° Baume for the reason that heavier oils are in most cases asphaltic crudes or residuals which are not within the other and more important requirements. We can and will contract to burn heavier fuels, if samples are submitted from the source of supply, which show proper qualifications. As an instance, a 20° Baume crude from the Saratoga field, Texas, recently tested, proved to be a most excellent fuel, being close to all requirements, except gravity.

There seems to be a general impression extant that fuels of paraffin base are superior to those of asphalt base. While that may be true of some antiquated types, we find that the Bessemer gives equally good economy on asphalt base, paraffin base or cracked oils, as long as they comply with our specification.

For the guidance of owners of Bessemer Oil Engines in purchase of fuel as well as to assure prospective purchasers of our equipment that their local source of supply offers suitable fuels for our engines, we offer the services and experience of our laboratory and engineering departments. For the testing of oil of 24° Be (and above), a quart sample of oil will be sufficient, but for heavier oils we prefer to make an actual engine test and require a larger sample (not less than five gallons of the latter should be shipped). Upon receipt of prepaid samples in stated quantities we will immediately carry out tests and analysis, and report as to the operation and economy to be expected from the fuel submitted.

Fuel Economy

It is a well known fact among engineers that the economy of an engine increases with the size of its cylinders. As the difference is considerable as the size progresses, it follows that the single cylinder engine is invariably the most economical. Practical difficulties limit the size to which cylinders may be built without seriously complicating the design, so that we find it best to build twin engines for the larger sizes. But, for the reason that the single engines are considerably more economical, as well as much simpler, we urge that these be used wherever possible. Being two cycle, our engines have an exceedingly uniform turning effort and, therefore, do not require very heavy flywheels to meet guarantees for angular variation even with single cylinders.

The fuel economy will vary with the load, but it is a most fortunate property of our engines that it remains practically constant from three-quarter load to full load. Our fuel guarantee is not based on our best test stand figures but on a safe percentage above the upper limits of these figures; taking the 70 H. P. engine as an example, the consumption guarantee is 7-10 pints or .64 lbs. of fuel oil.

In adhering to this practice, we find that our guarantees are sometimes not quite so good as are those of competing engines which we know are not as fully developed as our own product. There is little to be gained by such policy and we much prefer the expressions of satisfaction from customers who report less fuel consumption than we guarantee to the notoriety which attends the removal of an engine for failure to perform its fuel economy. The economy of these engines is fixed by their construction according to more or less rigid laws and principles. We have dis-

cussed many of these in the preceding pages. Each phase of the Bessemer Oil Engine development has been based on the discovery of these laws through analysis and careful investigation, which fact warrants confidence in our predictions as expressed in our guarantees.

Lubrication

To get just the right amount of oil at the right place at the right time is a much-to-be-desired consummation and it is best achieved by mechanical force feed lubrication. Hence we are now placing on all Bessemer Oil Engines, Force Feed Lubricators, one that we believe to be the most efficient lubricator on the market. Being operated from the crank shaft, the amount of oil delivered is in exact ratio to the speed of the engine. A 13½ in. Bessemer cylinder has three oil feeds on it, insuring perfect lubrication, hence long life.

This lubricator has simple and positive Sight Feeds which enable the engineer to see how much oil is being pumped to each cylinder or part to be lubricated and the exact quantity per stroke of the plunger. The amount can be regulated from one drop to a full stream per stroke.

Each unit has independent adjustment and can be removed from the reservoir without disturbing the set regulations of the other pumps or removing the reservoir from the engine base. The adjustment is easily made by means of thumb nuts on top of the delivery plunger. A gauge glass in the reservoir shows the oil level.

All working parts of the lubricator are made of the best drop-forged steel, case-hardened, constantly running in oil so that wear on the lubricator itself is reduced to a minimum. Consequently, repair and upkeep expense is practically nil.

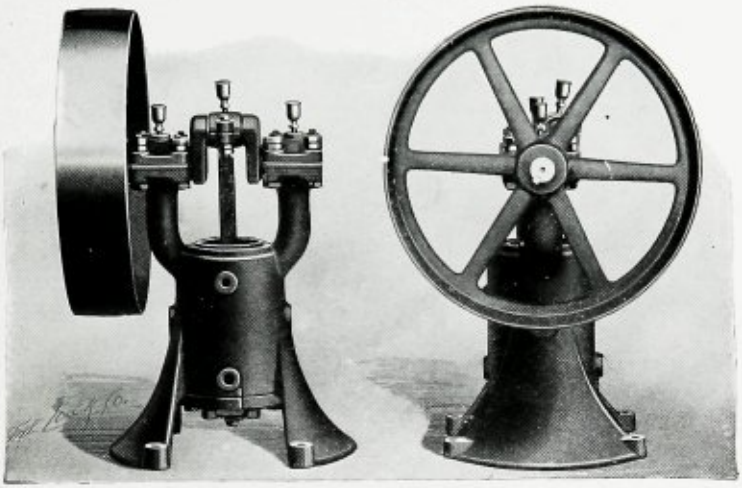
The main bearings, crank pin, crosshead and crosshead guides are lubricated by the splash system, the crank striking the oil in the crank case every revolution. Thus all these parts are operating in a continuous bath of oil. All surplus oil from the bearings drains back to the bedplate and the oil is thus used until it has lost all its lubricating value. Oil rings are placed on the shaft to keep the oil from being carried out and side plates are provided to force the return of oil to the bed. The front

end of the cylinder being of the closed type, with piston rod and stuffing box, overcomes an objection to splash lubrication in the ordinary trunk piston type of engine. We, therefore, have all the advantages of this form of lubrication and none of the disadvantages.

All dirt and dust is kept from the bearings and no oil is splashed on the floor or walls. This is an especially valuable feature in irrigation districts that are subject to sand storms.

A gauge glass on the bedplate shows constantly the level of the oil in the crank case.

Air Starting Outfit



Bessemer Air Compressor for Starting Bessemer Oil Engines

With every Bessemer Oil Engine air starting apparatus is furnished that is entirely in keeping with the high quality of the engine. It consists of a 4x4 vertical, single acting air compressor with water-jacketed cylinder, and an air tank tested to 200 lbs., pressure gauge, quick-opening valve and air-tight globe valve. This equipment is included in the price of the engine and forms a means for quick and easy starting.

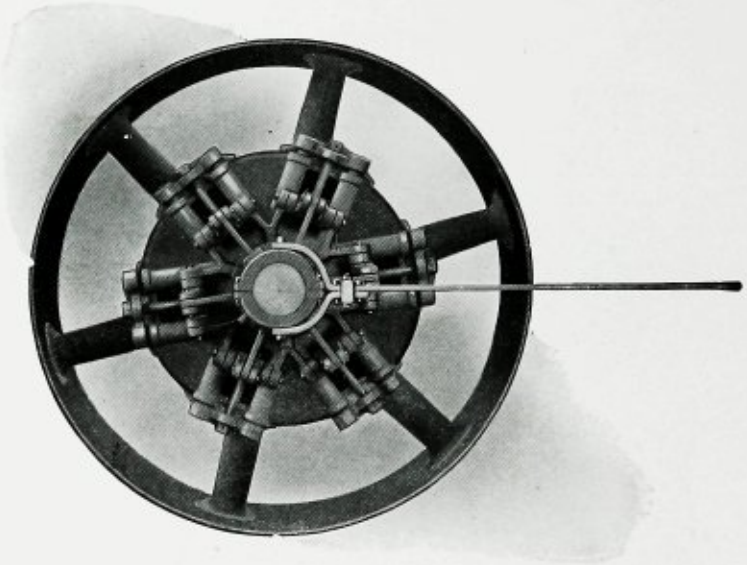
With certain of the larger sizes a 2 H. P. Kerosene Engine is furnished to operate the air compressor entirely independent of the larger unit.

Friction Clutch

Internal combustion engines on certain classes of work are more easily set in operation when a friction clutch pulley is placed on the shaft instead of the usual solid driving pulley. We recommend The Carruthers-Fithian Clutch Company Friction Clutch pulleys as a clutch equipment.

They can be secured in sizes up to 86″ diameter and in width of face up to 36″.

These two types are built, as follows: *Automatic Type*, which is automatic in adjusting the friction pressure to carry the load, also automatic in adjusting for wear.



The Carruthers-Fithian Clutch, Outside Friction Type

Lever Outside Friction Type, which is thrown in and out with a lever and which requires manual adjustment for friction pressure and also for wear.

Either type will give good service when properly placed and adjusted on Bessemer Oil Engines.

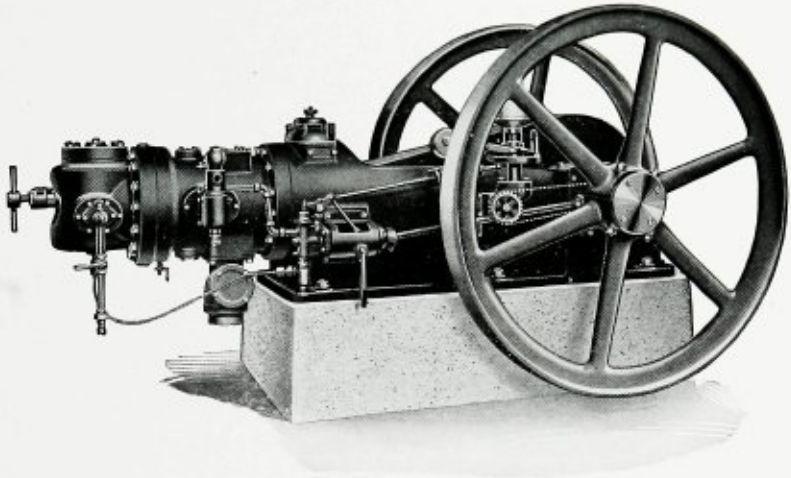
When Bessemer Oil Engines are direct connected to machinery on which the load may be placed after the machinery is in operation, as an electric generator, it is customary to use a flexible coupling instead of a friction clutch, and when direct connected to pumps or line shafting a friction cut-off coupling is used.

The Carruthers-Fithian cut-off coupling is also of the outside friction type, similar to the friction clutch illustrated, except that no pulley is used.

These clutch pulleys are carried in stock by us in a wide variety of diameters and width of faces.

The Carruthers-Fithian Clutch is a strictly high-grade mechanism, entirely in keeping with the high quality of the Bessemer Oil Engine, of which it is an accessory. And it is typical of all the accessories furnished —none but the best procurable are used.

The Bessemer Type OD Oil Engine



The Newest Bessemer—Type OD Oil Engine

The OD series, thoroughly developed by extensive trials both experimental and in actual service, have received ready and enthusiastic acceptance in the power field.

The standard OD engines are fitted with a centrifugal governor with a very convenient running speed adjustment from 160 R. P. M. as a minimum to the rated normal speed of 275 R. P. M., or higher if used for oil country operations of intermittent character. This governor will regulate with accuracy suitable to any commercial need. The OD special electric engines are fitted with the shaft governor used on our Type IV series, and thus equipped will equal any automatic steam engine for regulation.

The fuel pump and governor used on this series are of the same character in workmanship and thorough design as those used on our Type IV line. The cost of these parts bears a rather disproportionate relation to the total engine cost, but neither manufacturer nor purchaser can afford anything but the best in these details. They are vital to both regular and economical operation.

The main reciprocating and rotating parts and their bearings are novel in design and we feel that they represent the ideal of low cost through economy of material and workmanship rather than mere cheapness. They will bear the scrutiny of engineer or mechanic and find favor.

The heavy parts run in an oil bath held in the engine bed and perfectly retained by an oil-tight sheet metal hood.

Cylinder, governor and fuel pump mechanism are lubricated by a high-class force-feed lubricator, according to our standard practice.

All metals are bought to the specifications employed for our Type IV line.

The OD series does not employ water injection as does our Type IV line, this change being due to a call for engines of this size to operate in oil territory where frequently nothing but brackish water is available, also by reason of its being a variable speed engine. Our constant temperature head, fitted to this line, allows the same economy of fuel and freedom from carbon deposits as with water injection.

Write for special OD Bulletin if interested in this particular engine.

Home Office and Factory, Grove City, Pa.

The Bessemer Factory

We extend to you a cordial invitation to visit our factory and investigate our methods of casting, machining, assembling and testing Bessemer Oil Engines. You will find our factory to be a veritable exposition of modern machine tools each manned by skillful, capable workmen. Beginning at our foundry you will find a modern building 597 feet long and over 100 feet wide equipped with seven 60-foot span electric cranes and with two huge cupolas from which pour the carefully mixed irons to make Bessemer castings. The quality of these castings is guarded by our laboratory in charge of a chemist specially trained in metallurgy. Into the machine shops the castings come, where one of the largest milling machines ever constructed, together with small ones, machine the bed plates. The cylinders pass to four special cylinder boring machines where they are machined by solid reamer heads. The flywheels are sent to large boring mills which bore the hubs and face the rims at one setting, insuring true running wheels. The small parts are distributed to a wide variety of lathes, shapers, planers, milling machines and automatic machines of various kinds. The assembling of these parts into the complete engine and the testing of the engine is accomplished in our large testing room where twenty-five engines may be tested at one time and thus one engine need not be hurried off to make room for another. Every test is thorough and complete. Five large electric traveling cranes serve the machine shop floors. Every means for economical production is used that we may give the utmost value for the money we ask you to invest. Quantity production further assists to this end.

A Corner in the Metallurgical Laboratory

Here, too, you will find an engineering organization who are not only willing but anxious to be of service in solving your power problems.

Come and see that our claims for Bessemer superiority are based not on mere words, but on actual facts. You will find our claims for superiority to have been conservative, and when you have been through this, perhaps the largest and certainly the best equipped exclusive gas and oil engine factory in the United States, you will believe what 26,000 buyers of Bessemers know, viz.: "You Buy the Best When You Buy the Bessemer."

Guarding the Quality of Bessemers

There is no guess work about either the design or construction of Bessemers.

We maintain a complete metallurgical laboratory, perhaps the only one maintained by an exclusive gas engine concern in the whole United States. Thus the quality of the iron, steel, bronze and babbitt is proven —not left to hit and miss methods that may or may not be right.

Not only are all the resources of the laboratory used but mechanical means, notably the Shore Scleroscope—the wonderful instrument for testing metals—is used.

Bessemer Oil Engines being built from pig iron to complete engine under one roof, the constant vigilance we desire can readily be achieved. As the pig iron arrives it is analyzed to see that it is up to specification. Similar precautions are taken with the other metals. Then after the castings are made, tests are again made. All through the process of manufacture this surveillance and inspection continues. Then each completed unit is carefully tested, so that when the engine is shipped you have every assurance that it is right in material, workmanship and service.

So-called efficiency methods that would sacrifice quality of either materials or workmanship to speed have no place in our shops.

The United States Government

in Technical Paper 37 entitled "Heavy Oil as Fuel for Internal Combustion Engines" gives the following as the features that are desirable in a heavy oil engine:

1. The engine should primarily be constructed for burning heavy oils and residues, and particularly those oils containing asphaltums, as the petroleums of the Pacific and Gulf coasts, because these oils are produced in large quantities and are the fuels now available in commercial quantities.

2. The engine should start without delay or trouble.

3. It should show reliability and general good-running qualities.

4. It should run equally well at full load and at no load and with variable loads where variations are required.

5. It should run steadily enough to run a dynamo for electric lighting.

6. It should burn the fuel completely and not give an unpleasant odor or smoke from the exhaust.

7. Its first cost should be low.

8. It should be simply constructed and should not require a machinist of superior ability to care for it.

THE BESSEMER OIL ENGINE

possesses all these desirable features and many more.

In Conclusion

A catalogue can only be general. Let us be specific by your advising us of your power situation and thus permit us to advise and suggest intelligently. You may know just what a Bessemer Oil Engine installation will mean to you before it is necessary to spend one cent.

The power plant is the heart of your factory—not a wheel can turn, not a belt can run without an engine room behind it. With a poor power plant the entire factory is affected unfavorably.

The operation of this power plant must be charged against your profits. If its operation is costly, your profit margin must be close. If the cost of running the plant is reduced, it means larger profits to you and the placing of money in your own bank account instead of another's.

A comparison of the various forms of power available will satisfy you that a Bessemer Oil Engine will save and make money for you from the day on which it is started. If such a result cannot be achieved it would not be our desire to sell you.

Do you know that it is really difficult to impress you with the economy and reliability of Bessemers—that we must hesitate about telling you all the wonders of this modern means of power production for fear it may cause distrust to arise in your mind and the thought to come, "It cannot be that good, it cannot mean so much to me."

So that is one reason for the conservativeness of this catalogue, for the absence of adjectives, red ink and capital letters.

But to you who will investigate Bessemer Oil Engines as applied to your particular requirements there is a pleasant surprise awaiting. For here is an engine so simple, so economical, so reliable, that to choose any other form of power would be a big handicap to your business success.

We ask for your business after you are satisfied that we can serve you best. We ask for it not on promises, but on actual guaranteed results based on the experience not only of hundreds but thousands of other business concerns, factory, mill and mine owners and what they have accomplished with Bessemers.

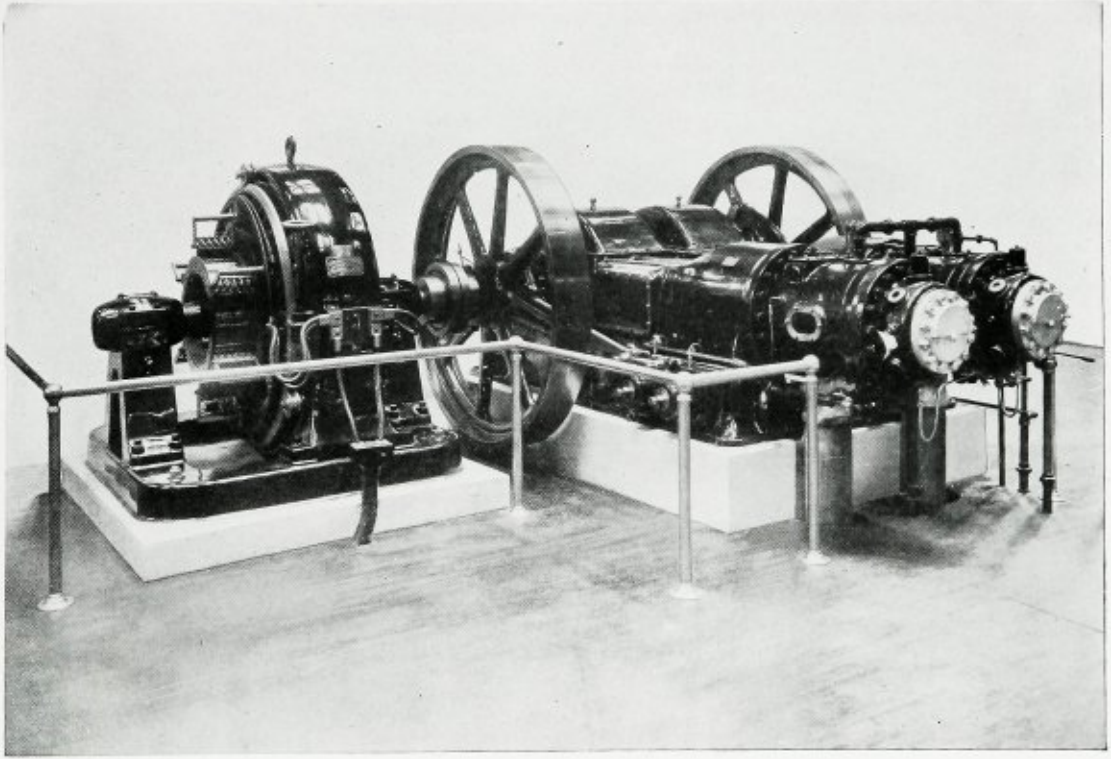
It is our intent to sell you not alone engines, but engine service, and you will find Bessemer offices and service stations or distributors near you, no matter in what section of the United States you may live. Other countries are covered by distributors who are well informed and capable, some of them having spent some time at the home factory. Home office salesmen, who are in most cases engineers, travel everywhere to assist you in solving any power problems.

For irrigation and reclamation projects usually promoted far from machine shops or expert help of any kind, Bessemers are peculiarly adapted, due to their simplicity and reliability. That which makes them best for such installations also makes them best for crowded cities.

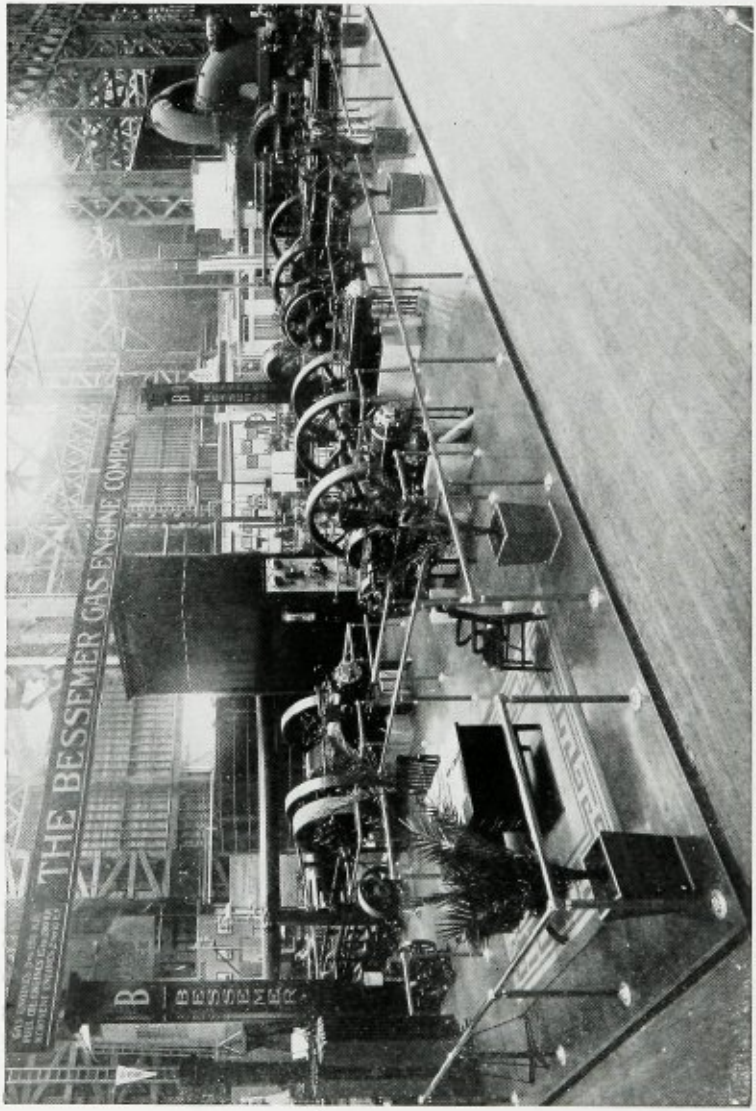
Printed pictures can give you a good idea of the value of Bessemer Oil Engines, but cannot do them justice. Only the engine itself can impress you with its sterling worth. Permit us to tell you of engines near you that you may see them and talk with their owners regarding the service they receive from the engines.

You run absolutely no risk in purchasing a Bessemer. Our guarantees are good. You will receive more than full value for the investment you are asked to make. We ask your patronage on the straight business proposition that we can serve you best.

THE BESSEMER GAS ENGINE CO.



Bessemer Oil Engines are Extensively Used and Especially Adapted to Electric Light and Power Plants in Towns and Cities as well as Private Power Plants. Illustration shows a Bessemer Oil Engine Direct Connected by Flexible Coupling to 100 K-W Generator.



Bessemers were Awarded Gold Medal at the Panama-Pacific Exposition

Other Bessemer Publications

In addition to this catalogue of Bessemer Oil Engines, The Bessemer Gas Engine Company have published the following catalogues and booklets which will gladly be sent you free, upon request.

BESSEMER COMMERCIAL CATALOGUE, illustrating and describing Bessemer Gas Engines for factory power plants and electric lighting plants, 5 H. P. to 165 H. P. Also Bessemer Direct Driven Pumps.

BESSEMER OIL FIELD CATALOGUE, describing and illustrating the famous Bessemer Gas Engine for oil field use. Also Bessemer Oil Well Pumping Powers and Bessemer Reverse Clutches. All standard oil field equipment the world over.

THE BESSEMER MANUAL OF GASOLINE RECOVERY, describing BESSEMER DIRECT GAS ENGINE DRIVEN COMPRESSORS for the compressing of gas and air. Also belted compressors, one and two stage, and Bessemer Vacuum Pumps.

THE BLUE BOOK OF BESSEMER BUYERS, listing the names of hundreds who have purchased Bessemers and profited thereby and illustrating many installations.

THE PRODUCTION OF GASOLINE FROM NATURAL GAS, a technical treatise on this additional source of income for the oil and gas producer.

TYPE OD OIL ENGINE BULLETIN, descriptive of the Type OD Bessemer Oil Engine.

THE BESSEMER MONTHLY, a house organ published each month, containing much original technical information of value. Also much of a popular nature. A monthly magazine of Bessemer progress.

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The Bessemer Oil Engines were extensively purchased and used by the United States Government. Their tests necessitated proof of reliability and dependability, close regulation and ability to burn a wide range of fuels, ranging from gasoline and alcohol to asphaltic crude of 17° gravity. The Bessemer met every test.

In France

Forty-two Type IV Bessemer Oil Engines were installed behind the American lines in France. These engines furnished power to repair and machine shops, small arsenals, etc.

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Bessemer Oil Engines were widely installed in the camps and cantonments in the United States. They were used for electric lighting, operating water systems, etc.

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