WORTHINGTON

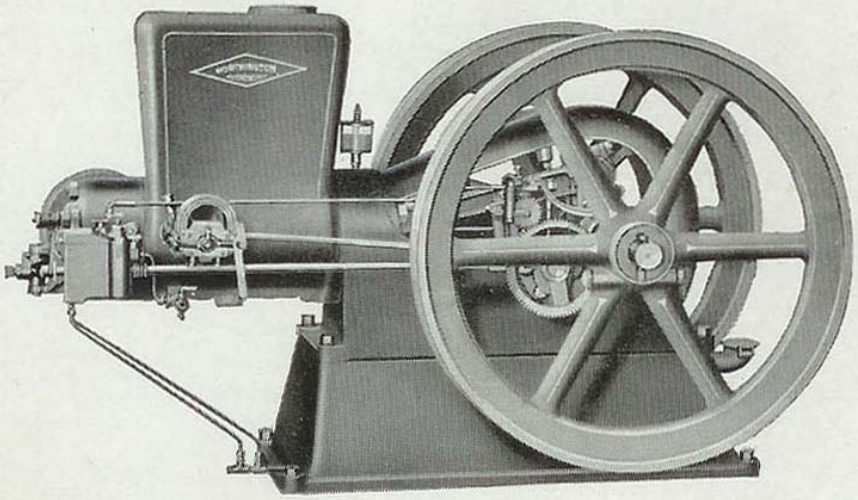
WORTHINGTON PUMP AND MACHINERY CORPORATION

115 BROADWAY, NEW YORK

Bulletin G-E No. 2 U. S. A. May, 1921

WORTHINGTON

Throttling Governor Kerosene Engines



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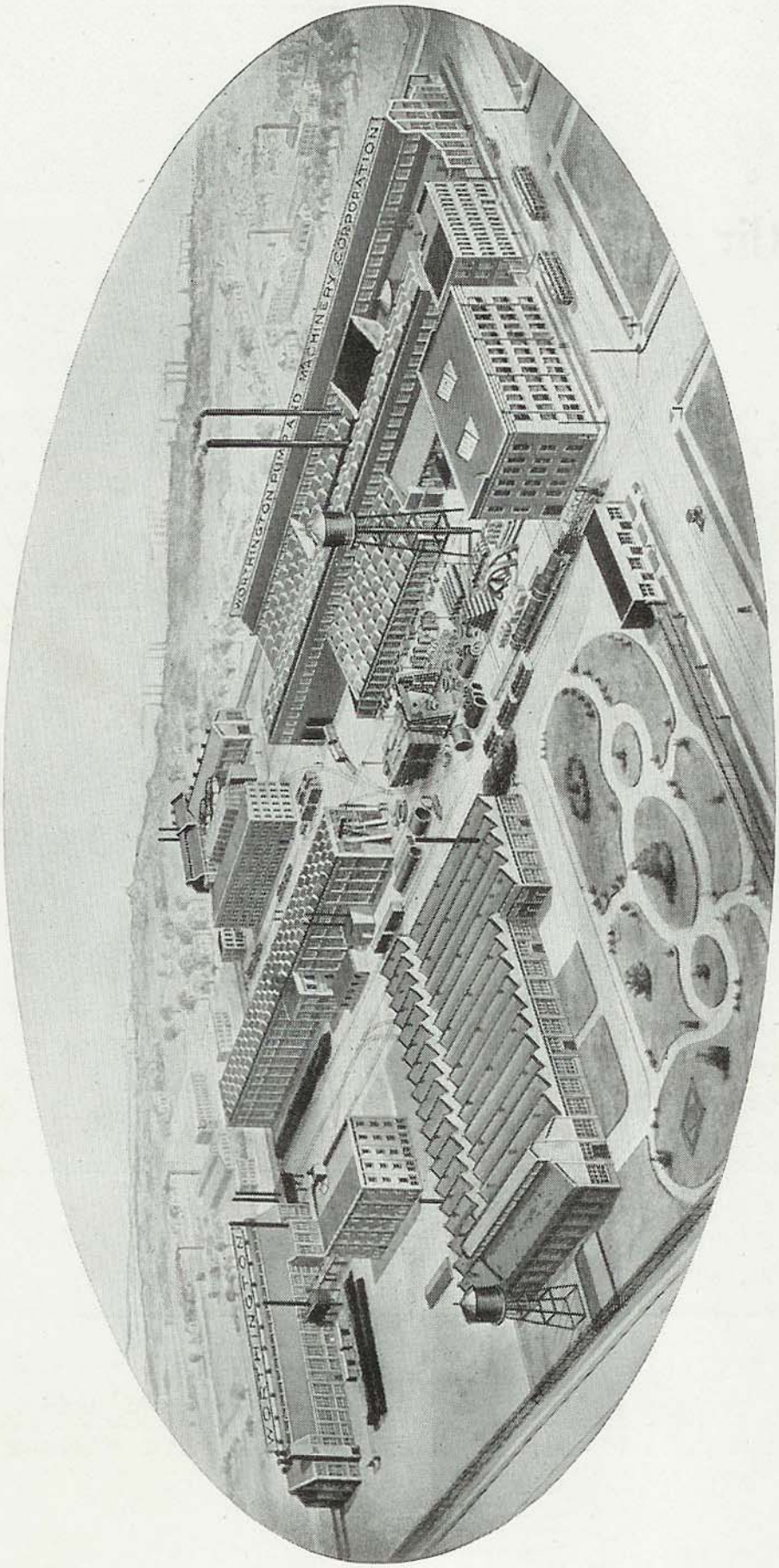
WORTHINGTON PUMP AND MACHINERY CORPORATION

GAS ENGINE WORKS

CUDAHY, WIS., U. S. A.

(SUBURB OF MILWAUKEE)



THE MAMMOTH WORTHINGTON GAS ENGINE WORKS WHERE THE FAMOUS
WORTHINGTON KEROSENE ENGINES ARE MADE.
LOCATED AT CUDAHY, WIS., U. S. A., A SUBURB OF MILWAUKEE

FOREWORD

The purchase of an engine involves a decision of real importance —not that the first cost is so vital a factor, but the engine must be one that insures efficient operation together with low maintenance cost.

Efficient operation is largely a matter of design. This bulletin has been prepared with the idea of showing design details as evidence of the efficiency of the WORTHINGTON Kerosene Engine. Back of these features is the WORTHINGTON engineering organization, builders of internal combustion engines up to 4000 H.P. in size and makers of the largest gas engines in the world.

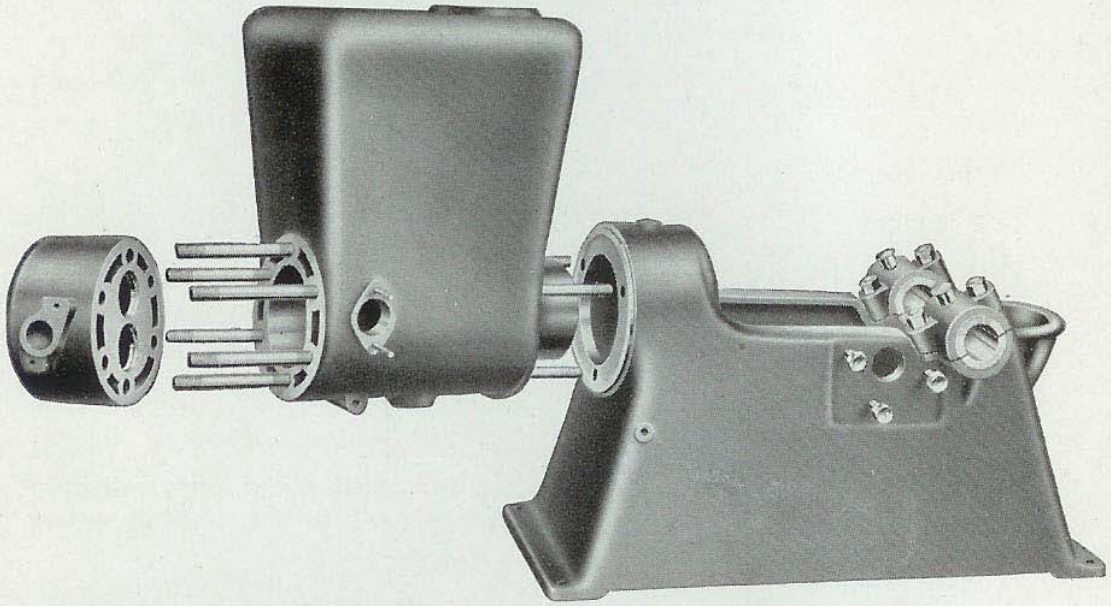
Progressive inspection together with up-to-date manufacturing methods are responsible for the quality standard of workmanship in WORTHINGTON Engines. This quality standard soon becomes evident to the user of a WORTHINGTON Engine. Dependable operation and upkeep cost that is surprisingly low are the results of WORTHINGTON quality.

WORTHINGTON—a big name in the power machinery field—stands squarely behind this line of Kerosene-Gasoline Engines. Large power units with the WORTHINGTON name plate are in successful operation all over the world. The engineering knowledge incorporated in these large power machines has been focused on the design of WORTHINGTON Kerosene Engines.

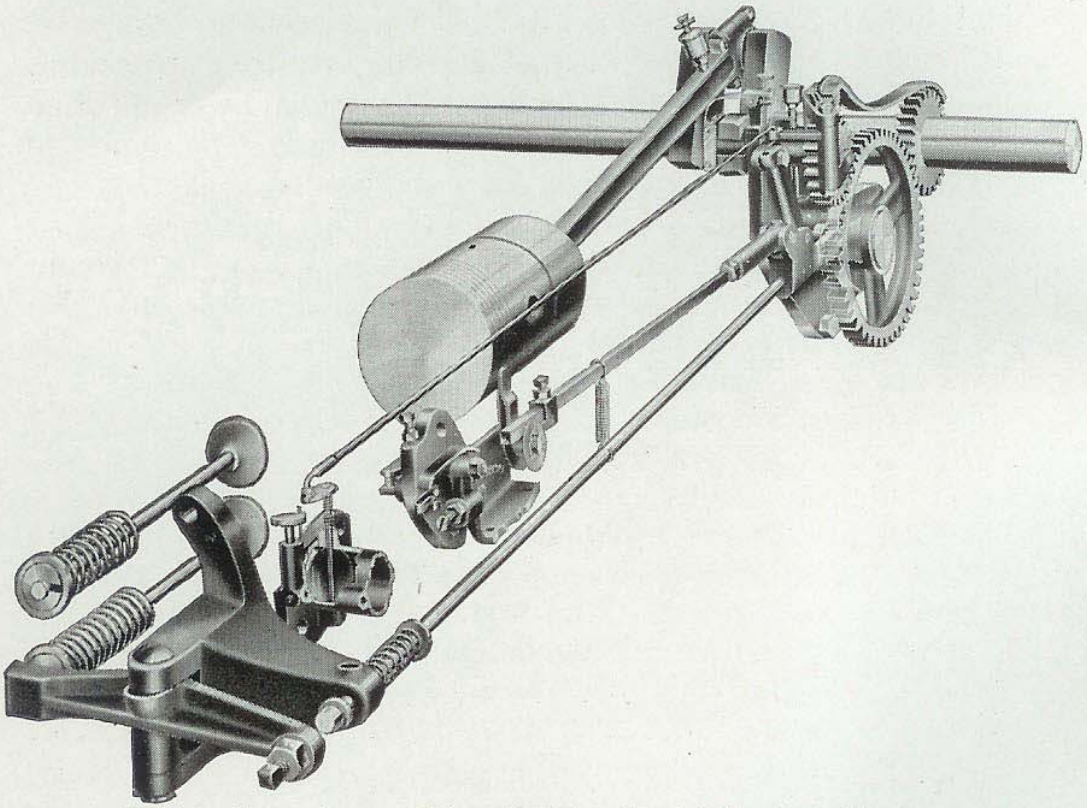
The specification and description apply specifically to the 2½, 4, 6 and 8 H.P. WORTHINGTON Kerosene Engines. The details of construction in the other sizes listed vary somewhat from the 2½ to 8 H.P., but in general the design is the same. All are of the Throttling Governor type, excepting the 1½ H.P. size.

WORTHINGTON PUMP AND MACHINERY CORPORATION
GAS ENGINE WORKS
CUDAHY, WIS., U. S. A.
(Suburb of Milwaukee)

WORTHINGTON KEROSENE ENGINES



Main Frame, Cylinder and Head separated but in correct relative position.



Complete Assembly of Principal Moving Parts.

SUPERIOR FEATURES OF DESIGN SUMMARIZED

The WORTHINGTON line of Kerosene-Gasoline Engines was designed to meet the demand for a better and more reliable engine than had yet been produced. The accomplishment of this achievement was made possible by the Company's vast resources, their engineering talent and knowledge of the requirements of the farm. Dependable service is recognized as the fundamental principle of success. An engine to meet with popular favor must be free from complicated parts, must be of a design so simple that it will be easily understood by the average purchaser, and operating conveniences must receive careful attention in a practical way. While the WORTHINGTON Engine is the very last word in gas engineering, the design is along conventional lines, embodying only tried and proven principles and is free from innovations.

The vital features—fuel feed and ignition—which play such an important part in the reliability of an engine, are taken care of in the most practical and effective manner. The fuel tank is located in the engine base—the fuel is supplied by a positive acting fuel pump, which is submerged in the fuel reservoir, requiring no packing. It is connected to the fuel tank by copper tubing and cinch fittings. A positive and uniform fuel supply is thus assured. The utmost in ignition dependability is realized by standardizing on the old reliable and recognized leader, the Webster Tri-Polar Oscillating Magneto, insuring positive ignition under severe weather conditions. This is operated by a hardened and ground steel cam. The magneto trip is located directly over the exhaust push rod and is connected close to same at the cam gear end. It operates in almost a horizontal plane, thus eliminating all side strains and unnecessary stresses on the tripping mechanism.

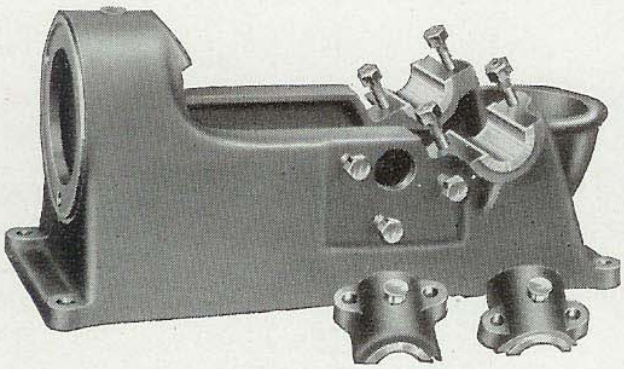
Every detail of design and construction, no matter how small, was thoroughly worked out—the purchasers' interest receiving the most careful consideration. The first and probably the most important construction feature is the design of the main frame, cylinder and hopper. To cast these parts in one piece is wrong in principle for in case of accident the cost of the renewal part is too great. Casting the cylinder and hopper separately is also wrong because of the obstructions hindering circulation, also the probability of

leakage at the gasket. These undesirable features are eliminated in the WORTHINGTON Engine by casting the cylinder integral with the hopper but separately from the main frame. The cylinder is attached to the main frame so that all bolts are in tension only and not subject to shearing stresses and as the cylinder over-hangs the frame, the expansion is equal in all directions. There is no liability of moving out of alignment and they cannot be distorted by bolting or fastening devices. This is of vital importance.

The following description of the details of design and construction features will be of interest and clearly show how thoroughly every feature has been developed.

DETAILED DESCRIPTION

2½, 4, 6 and 8 H.P. Sizes.

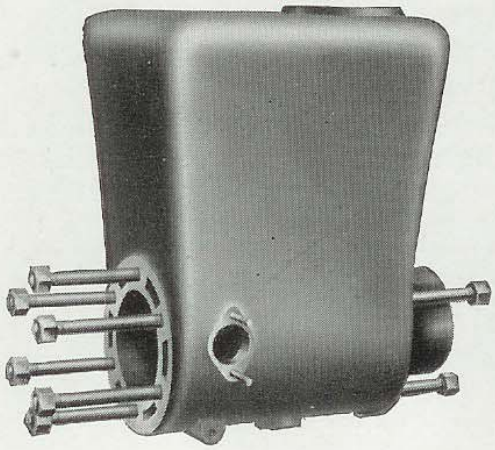


Main Frame.

MAIN FRAME—The main frame of the WORTHINGTON Engine is of very substantial design, heavily re-enforced along the inner edges and between points of greatest strain. The side walls are carried around at the crank end in such a manner so as to securely tie the main bearings together, also to serve as a support for the substantially designed sheet steel oil guard. This construction not only adds rigidity to the main frame, but, together with the ribs cast beneath the bearings, materially lessens the shock of the explosions and results in smoother and quieter operation. The importance of adequate strength and stiffness has been given careful consideration in the design of this part and to accomplish this the main frame has not been made unduly heavy, but the metal is so placed as to be of greatest service. The main bearings are inclined at an angle of 30°, accurately faced, and fitted with metal shims to facilitate adjustment. The main frames on the 4 H.P. and smaller sizes are a single casting, while those for the 6 H.P. and larger are provided with a lower base; but in all sizes there is ample clearance between the fly wheels and the floor.

The fuel tank is located in the base where it is protected from rough usage incident to handling and also requires less space for storage or shipping. The fuel pipes are of copper, not easily broken,

nor is there any probability of clogging due to rust or scale formations as is the case with iron pipes having screw threads. The filler pipe has a large funnel shaped opening permitting the fuel tank to be filled from an ordinary spouted fuel can, and is provided with a strainer and hinged cover. It is placed at the crank end farthest from the exhaust, making it possible to fill the tank without inconvenience while the engine is running.

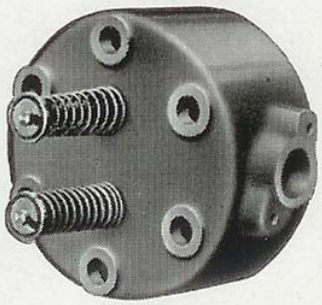


Cylinder.

CYLINDER—The cylinder is made from a special, close grained, wear resisting, hard iron and is a separate casting from the main frame. While this construction costs more than the one piece design, nevertheless, it is a much better arrangement from the viewpoint of the engine user. Should either of these parts be damaged by accident, they can be obtained separately at a much less cost than a combined cylinder and main frame casting. Manufacturers go to the one piece construction with only a view of lower production costs and not because it is of better design. There is no water joint or gasket between the cylinder and main frame, eliminating the possibility of water leakage at this point. The cylinder and hopper, however, are a single casting, also a superior design. The one piece construction obviates the use of gaskets always subject to leakage; furthermore the two piece design acts as a hindrance to the circulation. The only reason for resorting to a two piece cylinder is to cut down foundry losses.

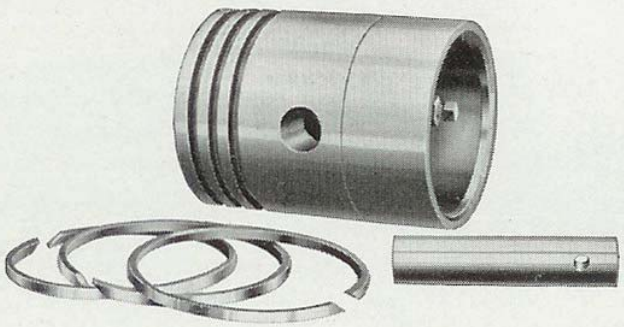
The hopper is symetrical and of pleasing appearance with straight sides slightly flared at the top. The shape provides a free and absolutely unrestricted circulation to the water, giving a better cooling effect with no probability of overheating. The filling opening is of ample size, placed nearest the crank end and farthest from the heat of combustion, permitting a greater amount of water being carried and reducing the possibility of splashing and boiling over to a minimum. Both the cylinder and main frame are accurately machined, which, together with the long fit at the neck of the cylinder, assures a rigid support and their being bolted together in perfect alignment. The fastening bolts are in tension only and not subject to shearing stresses. The overhanging cylinder allows free and even expansion when heated, with no tendency whatever to warp or distort as is the case when bolted on top of the main frame.

CYLINDER HEAD—Both the inlet and exhaust valves are in the head, a feature always found in engines of scientific design. This arrangement assures perfect combustion, greatest fuel economy, and absence of carbon formation. The valves are provided with exceptionally long guides which reduce valve stem wear to a minimum and also preclude the possibility of the valves not seating properly because of a worn guide.



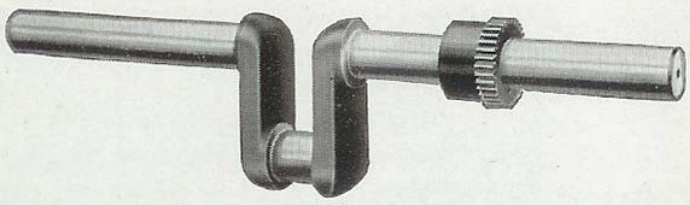
Cylinder Head.

The head is thoroughly water jacketed, the water space being entirely free from pockets or obstructions tending to hinder circulation. This ideal condition permits a maximum cooling effect and allows a perfect circulation around the exhaust valve seat which is subjected to the intense heat of the exhaust gasses. The path of circulation is from the bottom, past both valve ports and out at the top side back again into the hopper. It is very essential to have the head properly cooled.



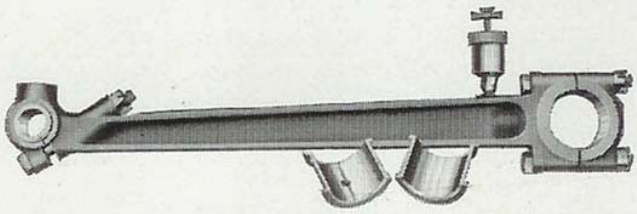
Piston, Rings and Pin.

PISTON, RINGS, AND PIN—The piston is of the usual trunk type, but of very liberal length and much longer wearing surface than ordinarily found on engines of this class. It is carefully machined, accurately ground to size, and fitted with three piston rings. These are made of a special mixture of proper elasticity and of sufficient wearing surface to insure good compression over a long period of time. The piston pin is of steel, hardened and ground, and is held in place by one set-screw and locknut. This arrangement permits of longitudinal expansion at the free end and does not distort the piston when the pin is lengthened by heat. This is a decided improvement over that of rigidly securing the pin at both ends as is usually found in this type of engine.



Crank Shaft.

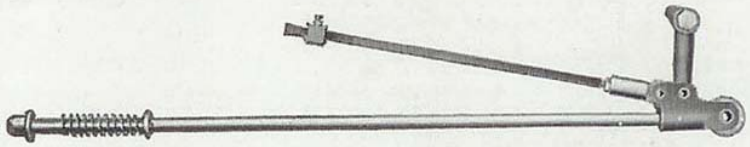
CRANK SHAFT—Is a drop forging of high grade steel, liberally proportioned, turned, and accurately ground to size.



Connecting Rod.

CONNECTING ROD—This detail is of "I" beam section to give it the required stiffness and is fitted with removable bearings at both crank and piston pin ends. The crank pin bearing is die cast babbitt and is provided with metal shims to facilitate adjustment, while the piston pin bearing is of bronze and for the 4 H.P. size and larger is provided with an ingenious device for taking up wear.

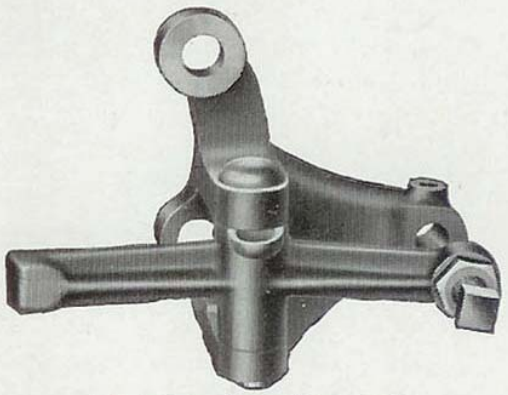
VALVES—The inlet and exhaust valves are located in the head, are of liberal size, accurately proportioned, and ground to a perfect fit. The stems are unusually long, perfectly guided, reducing wear to a minimum. The valve springs are held in place by means of a hardened steel keeper, except for the 2½ H.P. size, for which a hardened steel pin is used. This method of holding the springs avoids the use of threads or nuts.



Exhaust and Ignitor Push Rod Assembly.

EXHAUST PUSH ROD—Is of round, finished steel, of ample stiffness, suspended by a link at the crank end and substantially guided at the head end through the exhaust rocker arm bracket.

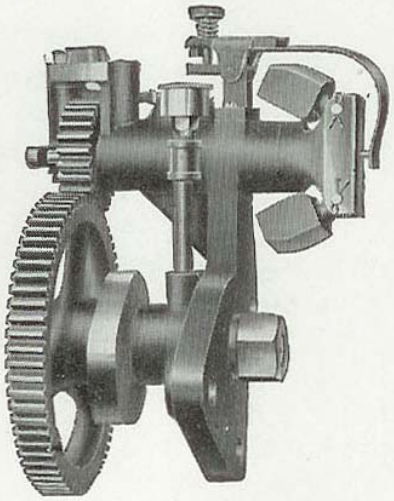
EXHAUST VALVE ROCKER BRACKET AND ROCKER ARM—This bracket is a detachable piece held in place by the cylinder head stud nuts and, being of forked construction, provides a top and bottom support for the exhaust rocker arm. The cam acts on a bronze bushed, hardened steel push rod roller in direct line with the rod, thus eliminating all side strains tending to cause wear. The action of the push rod is quiet and positive at all times, assuring perfect movement to the valves and ignition tripping mechanism.



Rocker Arm Bracket.

BEARINGS—All bearings, except that for the piston pin, are made of high grade babbitt. The main bearings are machine faced and the crank pin bearing die cast, both being fitted with metal shims to facilitate adjustment. The piston pin bearing is of high grade bronze, and with the exception of the 2½ H.P. size, is adjustable for wear.

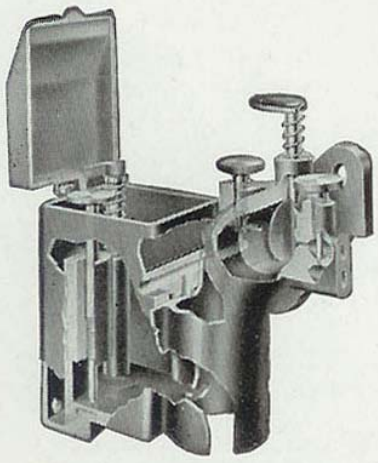
GOVERNOR—The high speed, fly ball type governor operating on the throttling principle is driven by the cam gear. It is powerful, yet sensitive to the slightest variation, always maintaining a uniform engine speed under varying loads. The speed regulator acting directly on the governor is so designed as to permit a reduction of speed to a consistent point, but will not increase the speed above normal. The entire governor assembly is of unit construction and can be readily removed by unscrewing three cap screws.



Governor.

GEARS—The governor and crank shaft pinions are of steel and the cam gear cast iron, all accurately machine cut and amply protected by a cast iron guard.

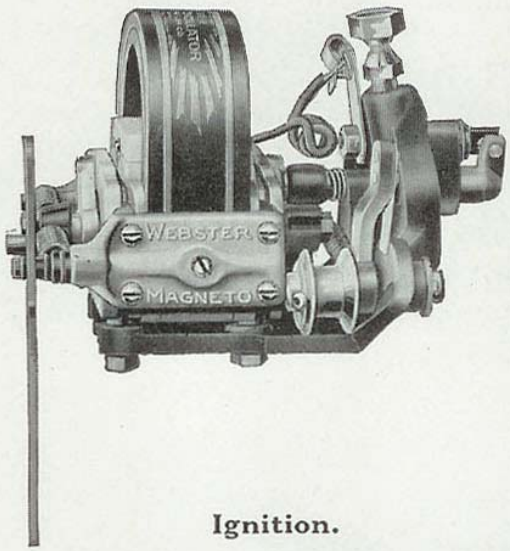
CAM—Is a steel forging, hardened and ground, and securely attached to the cam gear. This type of cam is far superior to a cast or chilled cam as all wear is eliminated, assuring quiet and positive action at all times.



Fuel Reservoir and Mixer.

MIXER AND FUEL RESERVOIR—This unit is a single casting and in addition to being a receptacle for the starting fuel, contains the fuel pump, throttling valve, also the fuel and water needle valves. The fuel pump is of the submerged type, requires no packing, and, because of its simple construction, is entirely reliable and assures a positive fuel supply. It is operated from a collar on the exhaust push rod, but may easily be held inoperative until the engine has become sufficiently warm to carry its load on kerosene. The complete assembly can be removed as a unit without disturbing any adjustments.

4 H.P. and larger are equipped with water spray which softens the explosions when the engine is carrying a heavy load and operating on kerosene. The engine operates on the throttling principle, the simplest form of balanced valve being used, which is under direct control of the governor and connected through a ball and socket joint, insuring proper alignment free from binding. The mixture is accurately proportioned in accordance to the load, engine speed is even and steady, and the cylinder temperature uniform, thereby insuring the greatest economy under varying loads. No other type of engine can operate successfully on kerosene or other cheap fuels.



Ignition.

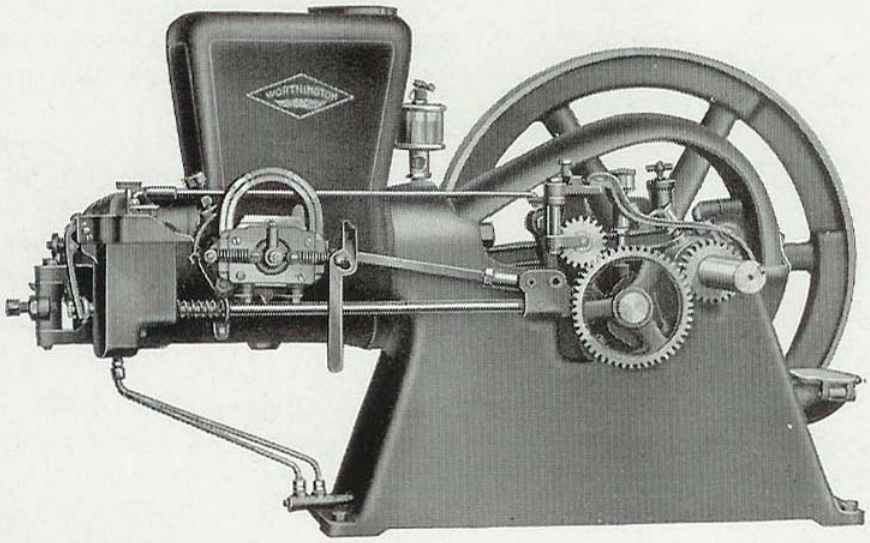
IGNITION—Is of the make and break type which has proved by long experience to be most reliable, especially for kerosene and other similar fuels. The ignitor push rod is located directly above and in line with the exhaust push rod to which it is connected at the crank end. Its path of travel is parallel to the exhaust push rod and, due to the angularity of the two rods, it functions in a positive manner, and all side strains to the exhaust push rod and tripping mechanism are eliminated. All sizes are furnished with the reliable Webster Tri-Polar Oscillator, assuring the maximum ignition dependability in all kinds of weather.

FLY WHEELS—Are accurately proportioned to counterbalance the rotating parts and due to the separate balancing of each wheel, a perfect running balance is assured. The hubs are split and gripped to the shaft by heavy bolts and keys. This method relieves the hubs of excessive strain and is a decided advantage when putting the fly wheels off or on.

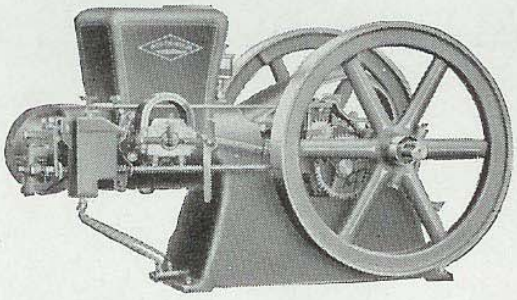
LUBRICATION—This important feature has received very careful attention in the design of the various parts. The cylinder, piston, rings, and piston pin bearing are lubricated by means of a sight feed cylinder lubricator, while the main and cam shaft bearings are provided with compression grease cups. An automatic spring grease cup on the connecting rod provides positive and continuous lubrication to the crank pin bearing. Ample provision has been made for oiling all parts, the oil holes being large, convenient, and accessible.

FUEL—WORTHINGTON Engines were designed primarily for operation on kerosene and other cheap fuels, but will operate on gasoline as economically as any gasoline engine.

STARTING—The ease with which WORTHINGTON Engines are started even when exposed to very low temperatures is a feature appreciated by all engine users. In starting, it is only necessary to fill the reservoir with gasoline, hold the fuel pump lever inoperative and prime through a conveniently located priming cup. The ignition is then retarded and the engine cranked rapidly in the direction it is to operate, when it will start readily. With the larger sizes it may often be more convenient to start the engine by pulling the piston back against compression, and the instant it has reached the end of its travel, the magneto is operated by means of the hand lever. To do this, the magneto should be cocked and the lever given a blow with the hand at the proper time. With a little experience this can be done without any inconvenience whatever. After the engine has run a few moments on gasoline and is warm enough to operate on kerosene, the fuel pump is again unhooked so as to draw the regular supply of fuel from the fuel tank. No other changes or adjustments are necessary when changing from gasoline to kerosene.



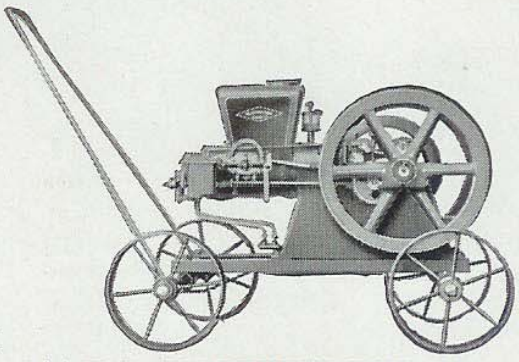
WORTHINGTON Kerosene Engine with Fly Wheel on Governor side removed showing Governor with Speed Regulator and Webster Tri-Polar Magneto and ignition equipment.



2½ H.P. WORTHINGTON Throttling Governor Stationary Kerosene Engine.

A REAL KEROSENE ENGINE IN A 2½ H.P. SIZE

THROTTLING GOVERNOR ASSURES STEADY OPERATION OF DRIVEN MACHINE



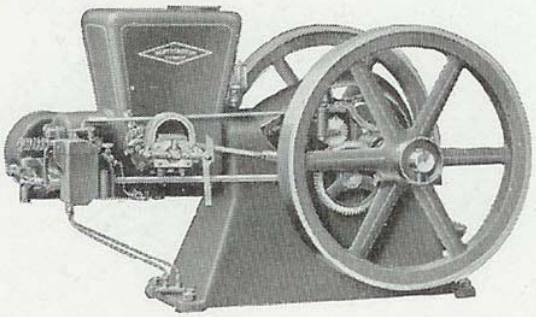
2½ H.P. WORTHINGTON Engine Mounted on Hand Truck.

WORTHINGTON Engines are built for business. They were designed with a full appreciation of the importance of reliable service. Dependable power is most desired by engine owners, with proper consideration for economy and maintenance cost. All materials entering into the construction of WORTHINGTON Engines are best suited for the uses intended. The factory is most modernly equipped with up-to-date tools and machinery for their entire production. The workmanship is of the best and inspections most rigid, with the resultant perfection in engine dependability and performance.

The thoroughness with which every feature of the design has been thought out is appreciated by the inexperienced operator as well as by those who are familiar with engine design and construction. The metal is accurately proportioned and distributed to absorb the shock of explosions but without surplus weight. The design is extremely simple with no complicated parts—still no operating convenience has been omitted. Look at the picture—Then turn back and read the description! Compare the details, part by part, with those of any other engine and you will be convinced of the superiority of the WORTHINGTON.

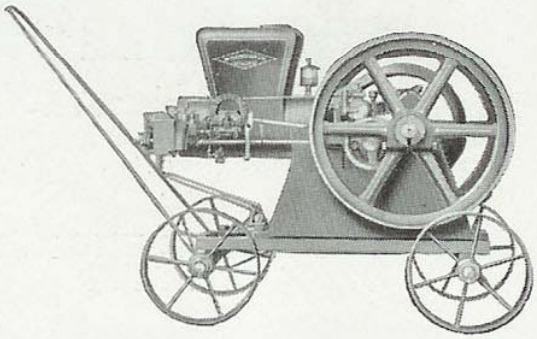
The 2½ H.P. WORTHINGTON Engine illustrated on this page fills the need for a small Throttling Governor Engine that will operate successfully on Kerosene. Its steady and uniform speed makes it the ideal size for the average milking machine, cream separator, electric light plant, wood saw outfit, and for general utility around the buildings or in the field. Many farmers prefer it to a smaller size for pumping water, and due to the fact that it will operate on the cheaper fuels, the cost of operation is no greater and the service is more satisfactory. This size is universally used on the farm and no farm is complete without this engine! The price is absolutely right.

A SIZE FOR EVERY POWER NEED



4 H.P. WORTHINGTON Throttling Governor Stationary Kerosene Engine.

THIS 4 H.P. ENGINE IS A GIANT FOR WORK—POWER —SERVICE



4 H.P. WORTHINGTON Engine Mounted on Hand Truck.

A COMPLETE POWER PLANT THAT WILL DO THE BUSINESS

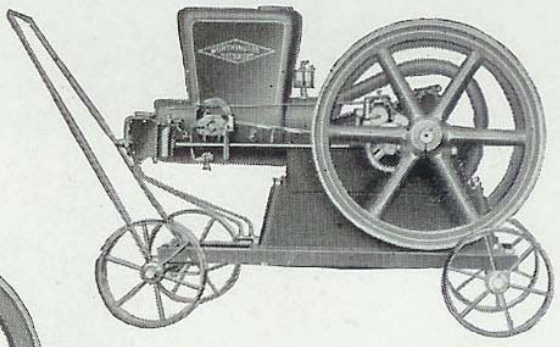
Here is the all around General Service Engine. This 4 H.P. Engine will take care of the general power needs of the average farm more often and in a more satisfactory manner than any other size. A little surplus power is often needed and can be used to good advantage. The cost over a 3 H.P. is trivial and only at the time of purchase. The advantages are lasting! Whenever the WORTHINGTON 2½ H.P. is not quite large enough you will be better pleased by deciding upon this 4 H.P. There is no intermediate size made in actual power development.

This WORTHINGTON 4 H.P. Kerosene Engine is the ideal size where it is desired to use the same engine for the various jobs around the farm. It is a Giant for work—A Complete Power Plant that will do the business! It will drive a feed grinder with corn and cob crusher, such as the New Holland, corn sheller, electric light plant, wood saw outfit, cream separator, milking machine, pump, etc., and as the fuel consumption is in proportion to the load, the cost of operation is highly satisfactory when doing any of these or similar jobs. Remember this is a REAL KEROSENE ENGINE—Operates on Kerosene and other cheap fuels as well as on Gasoline and will deliver the same amount of power from a gallon of Kerosene as from a gallon of Gasoline.

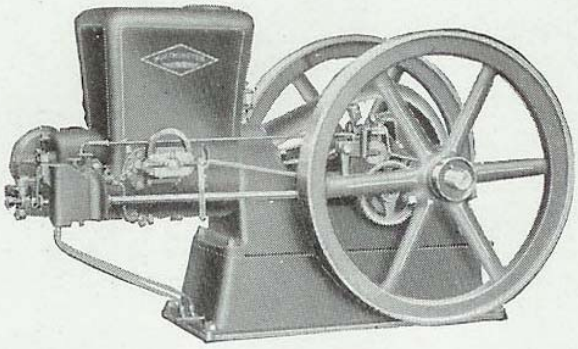
The 4 H.P. WORTHINGTON Engine is made with a water spraying device the same as all of the larger sizes. It is distinctive—just the right size and price!

WORTHINGTON QUALITY ASSURES DEPENDABLE SERVICE

WORTHINGTON ENGINES ARE DEPENDABLE



6 H.P. WORTHINGTON Mounted on Hand Truck.



6 H.P. WORTHINGTON Throttling Governor Stationary Kerosene Engine.

POWER TO SPARE EASILY STARTED AND UNDERSTOOD

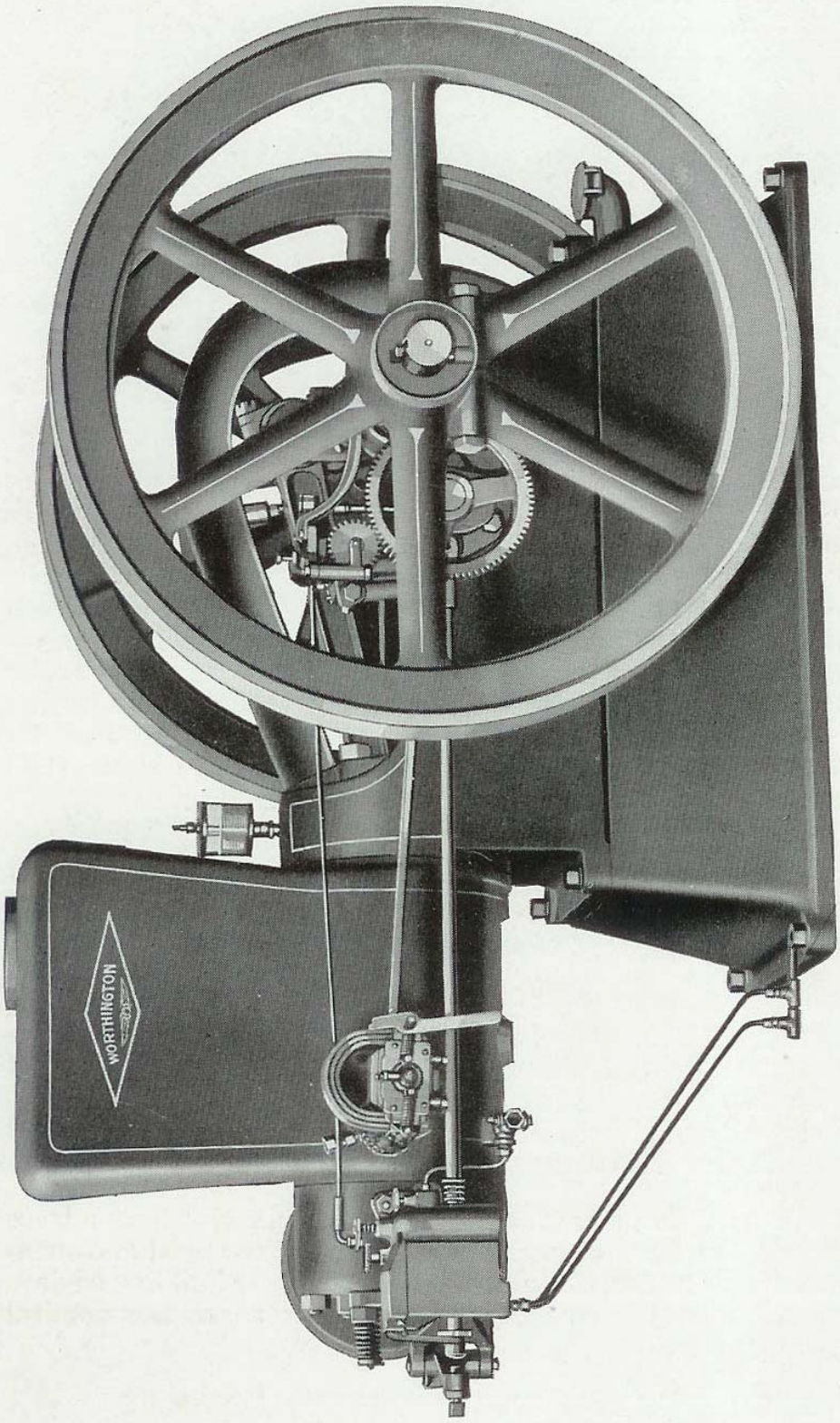
The 6 H.P. WORTHINGTON Engine illustrated on this page and the 8 H.P. on the two following pages, are wonderful engines—not alone in design, but in performance. The work to be done by engines of 6 and 8 H.P. and larger sizes is generally of an exacting nature, requiring full power development and the utmost in reliability. WORTHINGTON Engines fit squarely into these rigid specifications—they have the power and the maximum dependability.

Webster Tri-Polar Oscillating Magnetos are regular equipment on all WORTHINGTON Engines. This Magneto is well known and the recognized leader in ignition equipment.

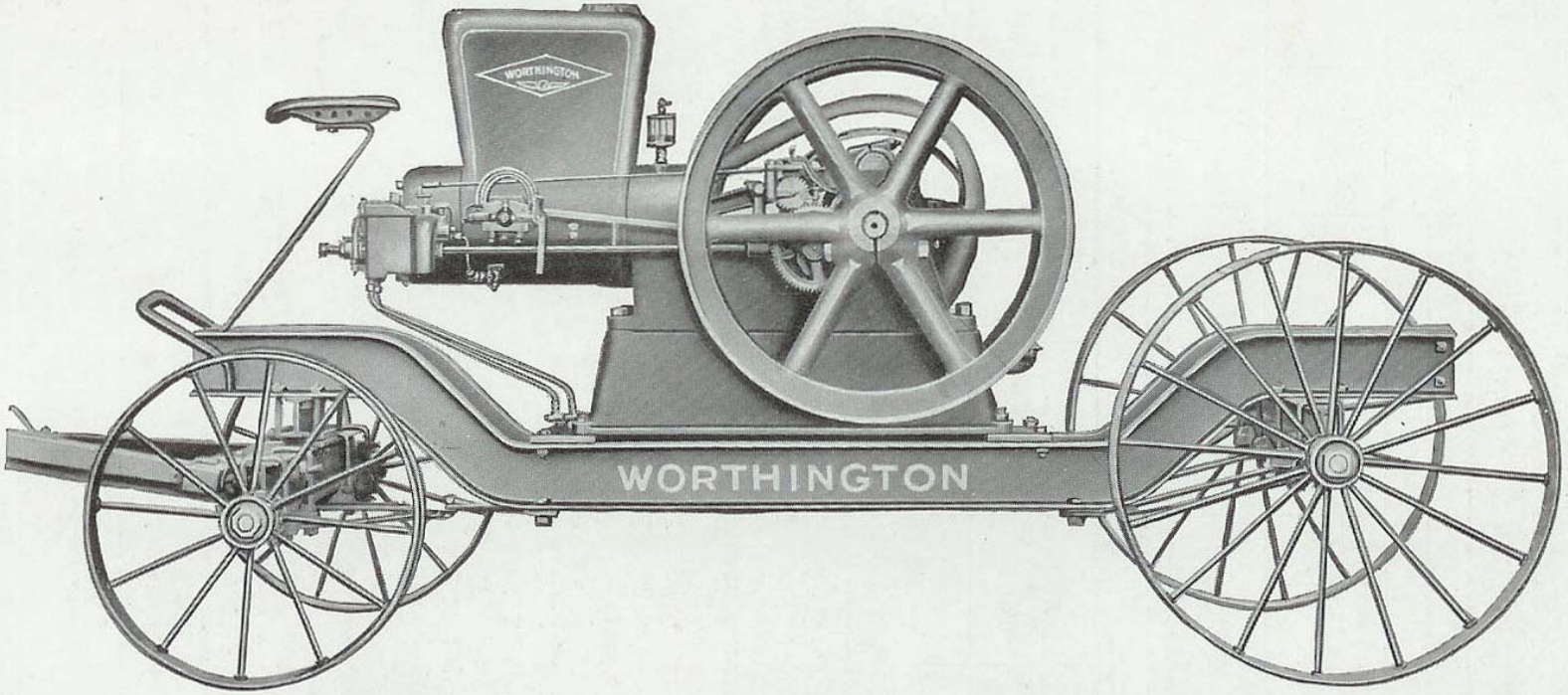
WORTHINGTON Engines larger than 1½ H.P. are REAL KEROSENE ENGINES and were designed primarily for operation on Kerosene and light distillates. They may, however, be operated on Gasoline and just as economically as a regular Gasoline Engine—and, by virtue of the Throttling Governor they have the additional advantage of more uniform speed.

There is a distinct advantage in selecting an engine from a large and complete line that offers a size for every power need and manufactured by a Company that has the reputation for building engines large and small, that will stand up and do satisfactory and economical work day after day.

WORTHINGTON ENGINES FOR ECONOMY AND SATISFACTION



WORTHINGTON 8 H.P. THROTTLING GOVERNOR KEROSENE ENGINE
THE MOST POWERFUL ENGINE MADE FOR ITS RATING



ILLUSTRATING 6 and 8 H.P. WORTHINGTON TEAM PORTABLE ENGINES

We furnish Hopper Cooled Engines mounted on Team Trucks from 6 to 15 H. P. This substantial all-steel truck is of the most rigid construction and the center of gravity has been carried to the lowest possible point.

ALL OF THESE TRUCKS ARE DRILLED FOR SAWING OUTFITS WHICH WE CAN FURNISH FOR ATTACHING IN THE FIELD

WORTHINGTON 2½ TO 8 H.P. THROTTLING GOVERNOR KEROSENE STATIONARY ENGINES, HOPPER COOLED

SIZES AND SPECIFICATIONS

Size H.P.	Speed R.P.M.	Size of Pulley		Fly Wheel		Approximate Shipping Weight	Code Word
		Plain	Friction Clutch	Dia.	Face		
2½	550	6″ x 4″	12″ x 6″	20″	2⅛″	400	Diary
4	475	10″ x 5″	14″ x 6″	24″	2⅝″	675	Dicky
6	400	12″ x 6″	16″ x 6″	30″	2⅝″	1050	Digit
8	360	14″ x 6″	20″ x 6″	36″	3¼″	1500	Dingo

Shipping weights given are for engines with plain pulleys. Add extra weight if friction clutch or special size plain pulley is ordered.

ALL STEEL TRUCK SPECIFICATIONS

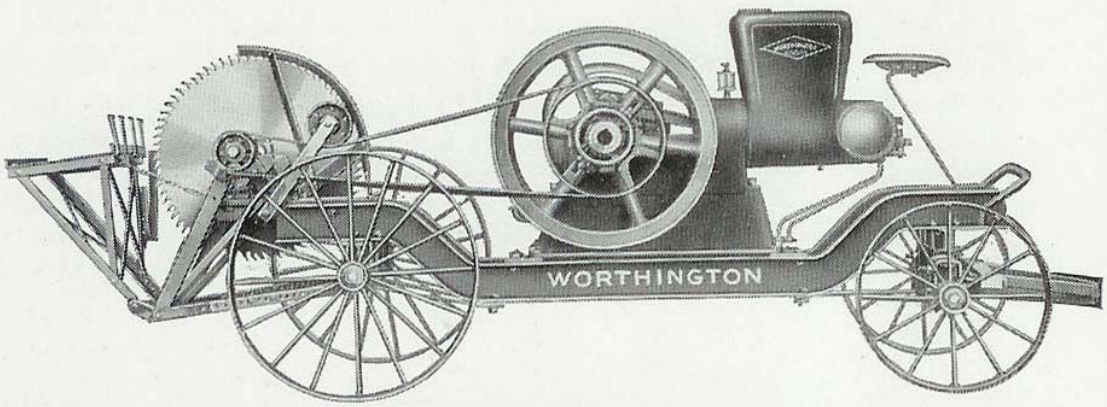
HAND TRUCKS

Size H.P.	Wheels		Approximate Shipping Weight
	Front	Rear	
1½	7″x2″	9″x2″	45
2½	7″x2″	9″x2″	45
4	14″x2½″	14″x2½″	135
6	14″x2½″	14″x2½″	135

TEAM TRUCKS

Size H.P.	Wheels		Approximate Shipping Weight
	Front	Rear	
6	24″x4″	32″x4″	650
8	24″x4″	32″x4″	650
10	26″x5″	36″x5″	1000
15	26″x5″	36″x5″	1000

When ordering a Portable Engine by telegraph, add the words "Hand Portable" or "Team Portable" to the engine code word given above. Portable outfits are not mounted at the factory. Trucks, either hand or team, are shipped knocked down and bundled, thus taking lower freight rate and lessening possibility of damage in transit.



WORTHINGTON PORTABLE WOOD SAWING OUTFIT

SIZES AND SPECIFICATIONS

Size H.P.	Speed R.P.M.	Size of Friction Clutch Pulley	Size Saw	Approximate Shipping Weight	Code Word
6	400	16″ x 6″	28″	2050	Dowel
8	360	18″ x 6″	28″	2500	Dowry
10	300	20″ x 6″	30″	3900	Drape

Left hand tilting table portable sawing outfits with friction clutch pulley are shipped knocked down. Not mounted at factory.

WORTHINGTON PORTABLE SAWING OUTFITS

Team portable trucks and wood sawing outfits with self-contained, mounted engines have been in such common use for so many years that every one interested in this class of equipment is entirely familiar with their uses. The WORTHINGTON outfits are especially distinctive owing to their general utility and all-around practical features.

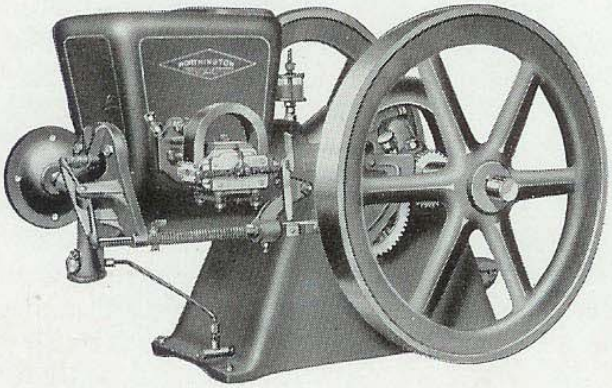
Our all-steel team trucks are of substantial construction, the side members being of heavy steel channels depressed at the center to receive the engine. This not only adds rigidity but carries the center of gravity down to the lowest possible point, overcoming any tendency toward top-heaviness. The operator will also appreciate this construction as it makes starting more convenient and provides ready access to the engine for oiling and adjustment. Strength to withstand the hard and severe service encountered on rough roads is provided for by the solid steel axles re-enforced the full length with heavy "I" beams, substantial braces to the side members, and the "I" beam front bolster. The construction of the wheels is in keeping with that of the truck as these are amply strong for any service. The channel side members are placed close together allowing ample clearance at the front wheels so that the truck will swing on a short circle.

The WORTHINGTON Portable Wood Sawing Outfit is a three-in-one combination. First, a regular stationary engine; second, a portable engine; and third, a pole or cord wood sawing outfit. The engine used is the regular WORTHINGTON Throttling Governor Stationary Kerosene Engine as described herein and is mounted on the truck complete without any special equipment whatever. The height of the truck, where the engine is mounted and the fact that it is mounted complete, make mounting and dismounting an easy job, and no tools other than a wrench are required. Every truck is properly drilled for attaching the engine and sawing outfit, simply a matter of putting in a few bolts, which can be done by any one.

The saw frame is the left hand tilting table type, the most practical for all-around sawing. It is made of heavy angle steel, strongly ironed, securely bolted together, and braced in all directions. Since WORTHINGTON Engines respond so quickly to changes in load, no balance wheel on the saw arbor is necessary or furnished. These outfits are therefore, just as suitable for sawing poles as cord wood. An improved belt tightener is furnished with each outfit. The saw arbor is of high grade steel and runs in babbitt lined bearings with ample oil chambers. The saw flanges are accurately turned and in perfect alignment, assuring quiet and smooth operation. It is not necessary to remove any part of the sawing attachment when moving the outfit from place to place as it is entirely self-contained and readily portable.

These outfits are most substantial and practical for men who make sawing their regular business and are a profitable investment for anyone who has poles or cord wood to saw.

1½ H.P. WORTHINGTON GASOLINE ENGINE

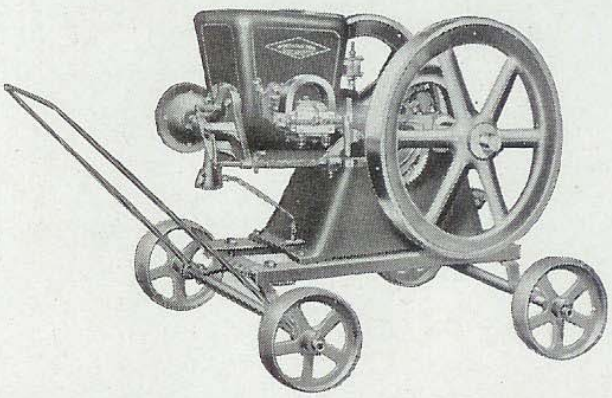


This engine resembles the WORTHINGTON Kerosene Line in general appearance and is built in accordance with Worthington's high standards. It is manufactured in the same factory—from the same high grade materials — with the same equipment and by the same skilled workmen—receives the same rigid inspection, test, and finish. This engine is precisely constructed in every detail, and all parts are standardized and interchangeable.

Like all WORTHINGTON Engines, the cylinder and hopper are cast integral but separate from the main frame. The water jacket is spacious, and the hopper of ample capacity, affording unobstructed circulation of the cooling water. The fuel tank is located in the base where it is protected against damage from handling, and is connected to the suction feed mixer by copper tubing and cinch fittings. No fuel pump is required on this type and size of engine, as suction feed has proven entirely satisfactory. The cam is of steel, hardened and ground, and rigidly attached to the cam gear. The governor is of the high speed, fly-ball type, and a speed regulator is provided for convenience in reducing the speed. The Webster Tri-Polar Oscillating Magneto is regularly furnished, assuring dependable and reliable ignition.

It has always been our constant aim to keep fully posted and in close touch with the demands of the engine trade. We have an intimate knowledge of the requirements of the farm, and through observation and careful inquiry we are fully convinced that for this size, the hit and miss type for operation on gasoline is far superior to the throttling governor type for operation on kerosene. The quantity of fuel used by an engine of this size is so small that the difference in cost of fuel between gasoline and kerosene is almost negligible, and our dealers and their customers are unanimous in their statements that they always operate their 1½ H.P. engines on gasoline anyway. These engines are largely used for pumping water,

driving milking machines, and operating cream separators, and as a rule, do not operate for long periods of time. They must be frequently and quickly started, which, of course, can more easily be done when using gasoline as fuel. Furthermore, the parts of a 1½ H. P. engine, if made throttling governor, are delicate, complicated, and sensitive to adjustment, and are more liable to breakage. We are pioneers in the building of throttling governor kerosene engines for the farm and are firm believers in this modification from 2½ H. P. up. Both courses were open to us and in the light of our experience and exhaustive research we chose the hit and miss type for the 1½ H. P. Apparently the experience of our trade is in line with ours as they are more than pleased with this engine. It is sturdy, powerful, simple, easy to understand, and the cost of operation and maintenance is exceptionally low.

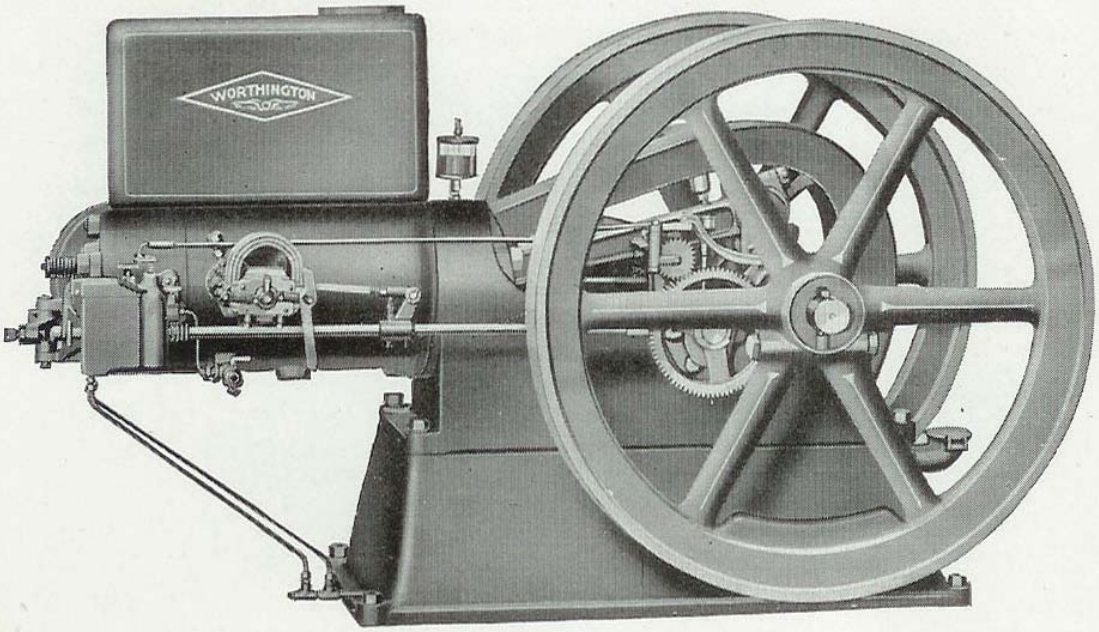


The 1½ H. P. size plays an important part in any line. While it is generally used for only short periods at a time, it must be capable of operating long periods if desired—it must be simple, easily started even in cold weather; in fact, an engine that the women folks can operate as well as the men. Its general purpose is to make the work around the farm easier—to do a lot of jobs that could be done by hand but more quickly and efficiently with a small engine, leaving more time for other work and recreation. Above all things, it must be dependable!

The WORTHINGTON 1½ H. P. is of the hit and miss governing type, designed for operation on gasoline. There are no delicate or complicated parts. Powerful and Economical, using fuel in exact proportion to its load. It is equipped with an efficient speed regulator and the old reliable Webster Oscillating Magneto—entirely dependable and the most wonderful engine at the price.

SPECIFICATIONS

Size H.P.	Speed R.P.M.	Plain Pulley	Fly Wheel		Approximate Shipping Weight	Code Word
			Diameter	Face		
1½	600	4″ x 4″	17″	1⅝″	275	Doily



10 and 15 H.P. WORTHINGTON THROTTLING GOVERNOR KEROSENE ENGINES

The 10 and 15 H.P. WORTHINGTON Throttling Governor Hopper Cooled Kerosene Engines illustrated here, are of practically the same design as the 6 and 8 H.P. WORTHINGTON Engines described earlier in this Bulletin except as to shape of the Hopper. While the proportion and form of some parts vary slightly on these larger sizes, the principal details are the same.

These Engines are equipped with submerged fuel pump located in the fuel reservoir, requiring no packing. The fuel tank is contained in the base of the engine and connected to the reservoir with copper tubing and cinch fittings. Engines are fitted with hardened and ground steel cam and Webster Oscillating Magneto, assuring dependable and lasting ignition. The opening in the Hopper is so located as to reduce boiling over to the minimum. The side walls of the main frame are carried around at the crank end, thus tying the main bearings together. This also serves as a support for the very neat and substantially designed steel oil guard. The fly wheels are made with split hubs to facilitate removing or putting on the shaft. The construction features are carried out in the same manner that characterizes all WORTHINGTON Engines.

The increasing demand for modern machinery on the farm has made engine power for farm use as indispensible and as staple as the plow. But, any engine will not do—the ideal engine for the farm must be adaptable to all of the needs of the farm—capable, economical, reliable, lasting! Only a properly designed and well constructed engine will render this service. The WORTHINGTON is just such an Engine. It was designed with a complete understanding of the requirements for power on the farm and manufactured under the most favorable conditions and in a thoroughly modern works.

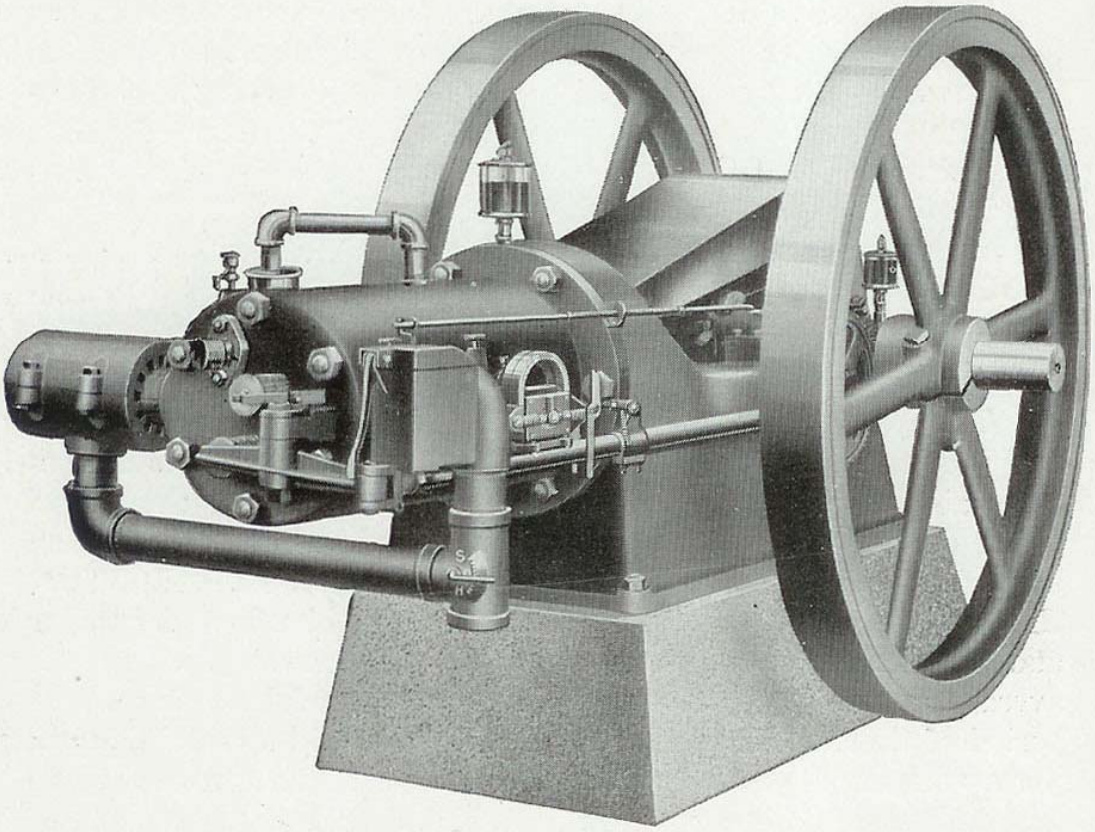
The WORTHINGTON Engine design embodies only tried and proven features. An inspection of the design shows a complete absence of what might be termed innovations, the efforts of the designers having been directed toward rational construction based on well known mechanical principles. WORTHINGTON Engines are therefore characterized as a combination of familiar and practical features, many of which will be recognized by the average engine buyer as having been in successful use for a long period of time. Special effort was made to avoid a multiplicity of parts without dispensing with the essential features necessary to accomplish the desired results with a high degree of efficiency.

The WORTHINGTON 10 and 15 H.P. Engines can be furnished either Stationary or Portable. When furnished as Portable they are mounted on the same type of all steel truck as shown on page 17. These engines were designed for hard and exacting service. They are of massive construction and will stand the most severe usage. They are long and rangy with a long stroke and slow speed, which assures the maximum in economy, dependability and long life.

These Engines are suitable for any class of belt power work but are especially adaptable for work on the farm, such as furnishing power for ensilage cutters, huskers and shredders, feed mills, corn shellers, cane mills, etc., Powerful—Economical—Uniform Speed.

SIZES AND SPECIFICATIONS

Size H.P.	Speed R.P.M.	Size of Pulley		Fly Wheel		Approximate Shipping Weight	Code Word
		Plain	Friction Clutch	Dia.	Face		
10	300	16″ x 6″	24″ x 8″	40″	3¾″	2500	Divan
15	250	20″ x 8″	28″ x 8″	48½″	4¼″	3900	Dogma



10-15-20-25 H.P. WORTHINGTON KEROSENE ENGINES INDUSTRIAL TYPE

SIZES AND SPECIFICATIONS

Size H. P.	Speed R.P.M.	Size of Pulley		Fly Wheel		Fuel Tank Capacity Gallons	Approximate Shipping Weight	Approximate Floor Space		Code Word
		Plain	Friction Clutch	Dia.	Face			Length	Width	
10	300	16″x10″	24″x8″	40″	3¾″	55	2600	77″	41½″	Delta
15	250	20″x12″	28″x8″	48½″	4¼″	55	3400	91½″	49″	Derby
20	235	24″x16″	32″x8″	56″	5¾″	55	4300	101″	65″	Derma
25	220	30″x16″	36″x8″	56″	5¾″	55	5500	105″	68″	Dhole

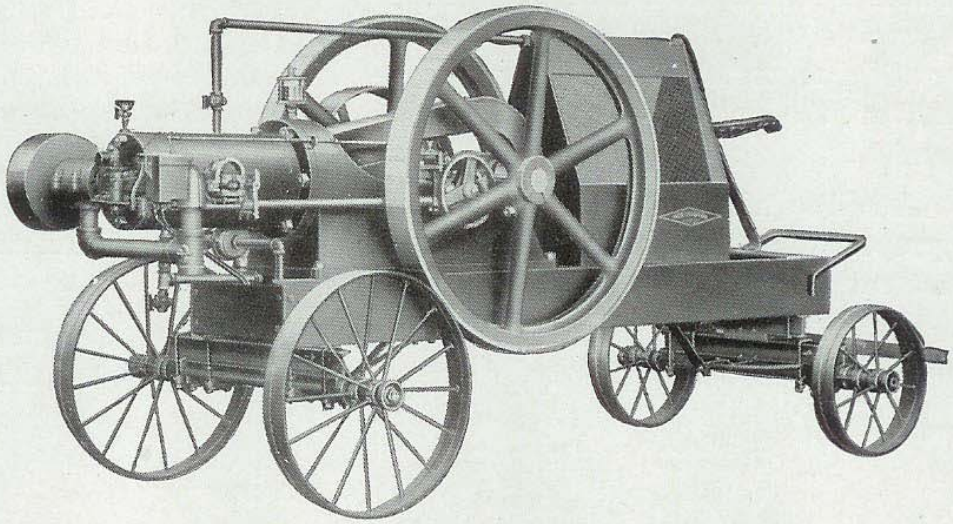
These Engines are equipped with centrifugal crank pin oilers so as to permit of continuous operation. All sizes are furnished as shown in the illustration, without sub-base. They are regularly arranged for cooling by running water but water tanks may be furnished if desired and we can also supply circulating pumps. Engines are fitted with a fuel pump of submerged type as more fully described earlier in this bulletin, hardened and ground steel cam and Webster Oscillating Magneto. The fuel tank is detached and may be located at the distance required by the Underwriters' Laboratories.

WORTHINGTON Throttling Governor Industrial Type Kerosene Engines were developed in response to the insistent demand of our trade for a good, substantial, economical and reliable engine that would operate successfully on Kerosene, light Distillates, and Gasoline and that could be sold at a reasonable price. In designing this line, our Engineers had especially in mind the requirements of the Grain Elevator Trade, Feed Mills, Saw Mills, City Water Works and Electric Light Plants, but they are suitable for any class of General Service where a good dependable engine is required.

In designing this line of engines for the Industrial, Municipal and large farm engine trade, the practical side of the question was taken into consideration in the most common sense manner. The design is most simple—plainest possible form of parts strictly adhered to, thereby reducing manufacturing costs to the minimum. Superfluous finish which merely adds to the cost is noticeably absent in the completed machine. The best commercial materials are used in the construction without recourse to special grades which would add greatly to the cost without securing commensurate returns in either durability or efficiency. The purchasers' interests have been taken care of in the design in the quite effective way of making the parts large enough to secure an ample factor of safety and best wearing quality. Since operating expense does not stop with fuel cost, but also includes repairs and maintenance, the above assumes special importance. WORTHINGTON Engines operate with the minimum total expense.

We also furnish these Engines mounted complete on all-steel trucks with screen coolers and circulating pumps. When so arranged they are unequalled for operating ensilage cutters, huskers and shredders, feed mills, saw mills, cane mills, corn shellers, threshing machines, etc.

PORTABLE INDUSTRIAL ENGINE WITH SCREEN COOLER



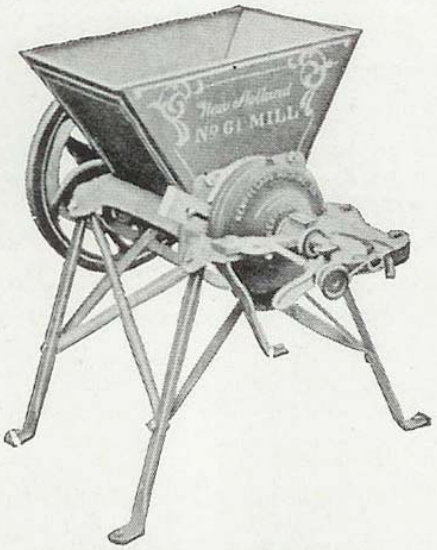
SIZES AND SPECIFICATIONS

Size H. P.	Speed R.P.M.	Wheels		Fuel Tank Capacity Gallons	Approximate Shipping Weights	
		Front	Rear		Truck Only	Complete Outfit
10	300	26″x5″	36″x5″	20	900	3500
15	250	26″x5″	36″x5″	20	900	4500
20	235	26″x8″	36″x8″	30	1350	6000
25	220	26″x8″	36″x8″	30	1350	7000

NEW HOLLAND FEED MILLS

The Original Single Shaft Corn And Cob Mills

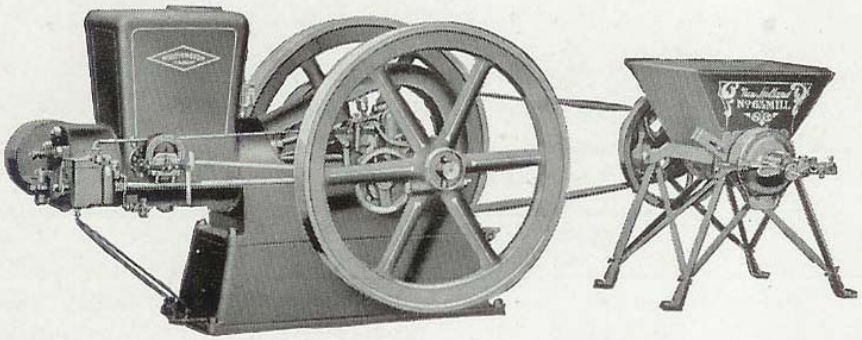
The advantages of feeding ground grain are no longer questionable among stock raisers and dairymen. Exhaustive tests made by the various government experiment stations in all states have demonstrated that feeding whole grain is wasteful and unsatisfactory. It is a well known fact that all the nutriments of corn are digestible, but animals do not masticate the grains thoroughly and a large portion is wasted. Corn meal is too heavy when fed alone —too hard to digest. Grinding the cob with the corn lightens the meal—increases the bulk, and is of valuable assistence in the process of digestion. Analysis has shown that a pound of corn and cob meal has the same feeding value as a pound of corn meal. There are many advantages in grinding the feed on the farm, but aside from the convenience, the stock has the benefit of fresh feed, ground in accordance with the requirements of the animals for which it is intended.



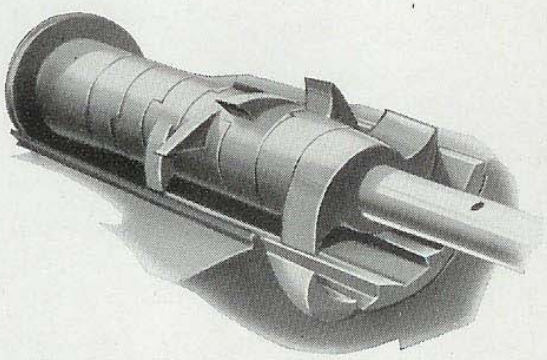
New Holland All Steel Feed Mill.

A mill to grind feed correctly without destroying the flavor must be properly designed, with crushers and grinding plates scientifically constructed.

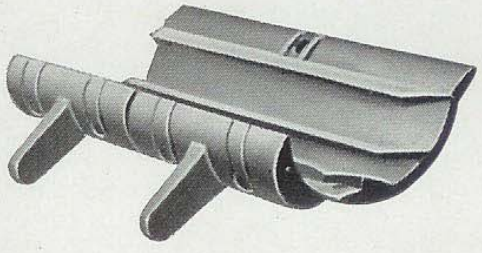
The New Holland is the Pioneer Line. There have been many attempts at duplication, but they resemble it only in outward ap-



No. 6½ New Holland Mill Belted to a Worthington Engine — an Excellent Combination.



Section Showing Cob Crushers Mounted on the Shaft.

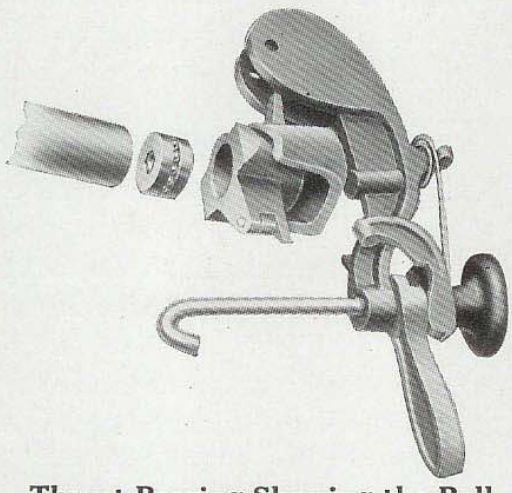


Concave Showing Sharp Edges Against Which the Cobs are Cut.

pearance—in actual operation there is as much difference as between day and night. New Holland Mills run lighter—last longer and are a source of greater satisfaction generally. They embody all the essentials of a perfect mill. "Simplicity and Efficiency" is the New Holland motto.

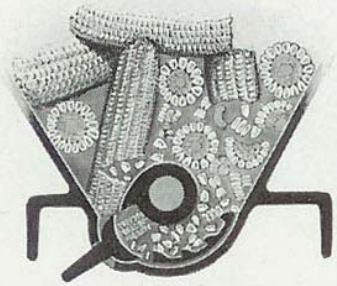
The New Holland Mill is of rugged construction, the main frame being a single casting which forms a firm base for the working parts. The plate flange to which the revolving plate is fastened has a long hub assuring perfect alignment of the grinding plates.

The cob crushers are located in the bottom of the hopper in sections arranged in spiral form on the drive shaft, to convey the broken cobs and grain into the grinding plates. These cob crushers have sharp cutting edges that pierce and cut the cobs, requiring very little power, even when the cob is bone dry. The points of these crushers are very hard and will crush thousands of bushels of ear corn without replacing.

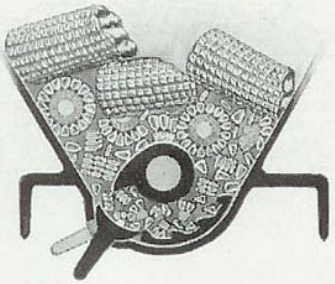


Thrust Bearing Showing the Ball Bearing and Assembly of the Parts.

New Holland Mills do not require special agitators, double rolls, gears, chains, or extra shafts to keep the cob corn from bridging, all of which consume power and are liable to get out of order. The supply of broken cob and shelled corn entering between the plates is regulated by means of a feed slide. The main bearings are extra long



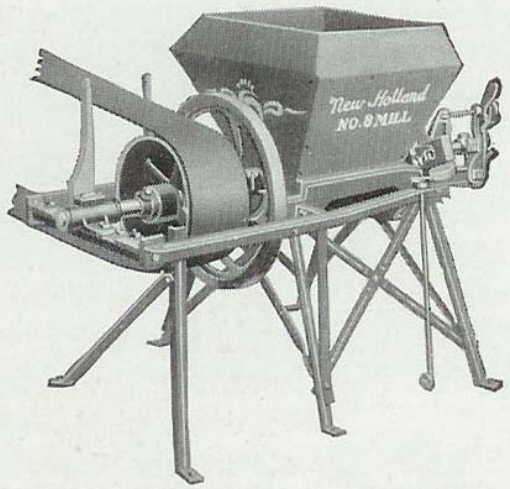
New Holland Mills are of the non-bridging type and are equipped with an adjustable concave. The concave is also reversible, thereby providing two sharp cutting edges.



and provided with ample oil cups, while the end thrust of the shaft is taken care of by a high grade ball bearing except in the No. 6 size for which steel and bronze discs are used. All mills are equipped with a heavy fly wheel and an extra set of grinding plates.

New Holland Grinding Plates are silent runners—have long grinding ribs—the shrinking strain being so distributed that an especially hard surface is produced without decreasing the strength. They will also grind much softer grain without choking than the ordinary grinding plates.

Larger sized mills, especially when arranged for tractor drive, should be equipped with a third bearing to carry the belt strain. To assure perfect alignment, the support of this bearing should come from the main frame instead of the floor or skids, as is the usual construction; a feature of utmost importance. The third bearing of the New Holland mill is supported by heavy angle irons rigidly bolted to the frame and equipped with a floor brace to take care of the belt pull. The three bearing New Holland Mills are especially adapted for the use of endless thresher belts. By removing one bolt, the bearing bar outside of the pulley can be pushed aside so as to admit the belt, the alignment or adjustment of the bearing not being disturbed. Mills of this type can be furnished in the No. 6½, 8, 10 and 12 sizes.



The No. 8 All Steel New Holland Mill With Third Bearing.

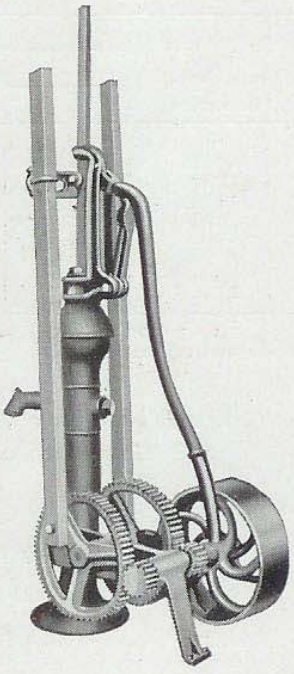
SIZES AND CAPACITIES

Number of Mill	6	6½	8	10	12	3
Size of Grinding Plates	6-in.	6½-in.	8-in.	8-in.	10-in.	12-in.
Capacity (Bu. per hour)	4 to 20	8 to 40	12 to 60	12 to 60	25 to 90	40 to 125
Horse Power	1½–6	2½–8	6–10	6-10	8—15	10–20
Speed of Mill (Rev. per minute)	500–1000	500–900	500–800	500–800	500–700	500–700
Most Suitable H. P.	2½	6	8	8	12	15
Size Pulley regularly Furnished	8 x 4	10 x 5	14 x 5	14 x 5	14 x 6	14 x 8
Size of pulleys furnished as ordered instead of regular size	10 x 4	12 x 5	16 x 5	16 x 5	16 x 6	16 x 6
	6 x 4	8 x 5	12 x 6	12 x 6	12 x 6	12 x 8
			10 x 6	10 x 6	10 x 6	10 x 8
Size of Mill Hopper	11 x 17	15 x 22	19 x 22	18 x 23	21 x 25	27 x 29
Diameter of Shaft	1	1¼	1¼	1¼	1½	1 15/16
Floor Space	26 x 26	30 x 41	30 x 48	31 x 42	36 x 48	45 x 49
Height Overall	29-in.	35-in.	36-in.	37-in.	40-in.	46-in.
Weight of Flywheel	22 lbs.	33 lbs.	33 lbs.	33 lbs.	50 lbs.	60 lbs.
Shipping Weight Complete	119 lbs.	208 lbs.	248 lbs.	248 lbs.	395 lbs.	600 lbs.

The slower speed of mill given above is for the lighter horse power and the higher speed for the larger power for ordinary feed grinding. If very fine feed or meal is desired the mill should be run at the higher speed listed. Capacity of the mill depends upon the condition of the grain and fineness to which it is ground. No. 6, 6½ and 8 Mills are of all steel construction as shown on Page 26, all other sizes are equipped with hardwood legs.

PUMP JACKS

The Double Geared Pump Jack illustrated here is for general use in connection with an ordinary hand or wind-mill force pump for pumping water out of small tubular wells. These are very inexpensive and easily attached to any pump of this description. The advantages of this type of Jack lie in its convenience, durability and cheapness. It is used in connection with a 1½ or 2½ H. P. Gasoline-Kerosene Engine. A regular stock engine is entirely suitable and the same engine may be used for other purposes. Every farmer knows the advantage of an adequate supply of fresh water especially in hot weather. By using a WORTHINGTON engine this is doubly assured. The whole outfit may be obtained for a very small amount.



This Jack is arranged for either 5″, 7½″ or 10″ stroke; gear ratio is 4 to 1 and it is fitted with tight and loose pulleys, 12″ diameter by 2″ face.

USEFUL INFORMATION AND TABLES

To Find the Size of the Driven Pulley:—

Multiply the diameter of the engine pulley by the engine speed and divide the product by the speed of the driven pulley and the result is the diameter of the driven pulley.

Example 1. Given the size of the engine pulley and speeds of the engine and driven shaft, find the size of pulley required:

Engine speed 400 R. P. M.
Engine pulley 20″ diameter
Shaft speed 800 R. P. M.

$$\frac{400 \times 20}{800} = 10\text{″ diameter of driven pulley}$$

Example 2. Given the speed of engine, size and speed of driven pulley, find the size of engine pulley required:

$$\frac{800 \times 10}{400} = 20\text{″ diameter of engine pulley}$$

To Find Belt Speed in Feet per Minute:—

Multiply diameter of pulley in inches by 3.1416, which gives the circumference of the pulley; this multiplied by the revolutions and divided by 12 gives the belt speed in feet per minute.

Example 3. Given a 20″ pulley running at 400 R. P. M., find the belt speed in feet per minute:

$$\frac{20 \times 3.1416 \times 400}{12} = 2095 \text{ feet per minute}$$

To Find the Width of Belt Required to Transmit a Given Horse Power:—

For a four ply rubber or canvas belt, multiply the horse power to be transmitted by 800 and the result divided by the belt speed will give the belt width. For a six ply belt, multiply the horse power by 600, and for an eight ply, 400.

Example 4. Find width of 4 ply belt to transmit 8 H. P. from a 14″ pulley running at 360 R. P. M.

$$\text{Belt speed} = \frac{14 \times 3.1416 \times 360}{12} = 1320 \text{ feet per minute}$$

$$\frac{8 \times 800}{1320} = 4.8 \text{ inches or a 5 inch belt}$$

TABLE FOR SINGLE LEATHER, FOUR PLY RUBBER OR CANVAS BELT

Belt Speed in Feet Per Minute	Width of Belt in Inches						
	2	3	4	5	6	8	10
	Horse Power Transmitted						
800	2	3	4	5	6	8	10
1000	2½	3¾	5	6¼	7½	10	12½
1200	3	4½	6	7½	9	12	15
1400	3½	5½	7	8¾	10½	14	17½
1600	4	6	8	10	12	16	20
1800	4½	6¾	9	11¼	13½	18	22½
2000	5	7½	10	12½	15	20	25
2200	5½	8¼	11	13¾	16½	22	27½
2400	6	9	12	15	18	24	30

Assuming a belt speed of 1400, a belt 4 inches wide will safely transmit 7 horse power without overloading.

Standard Sizes of Endless Canvas Belts

5″ 4 ply—50 ft., 75 ft., 100 ft.

6″ 4 ply—50 ft., 75 ft., 100 ft., 125 ft.

7″ 4 ply—50 ft., 75 ft., 100 ft., 125 ft., 150 ft.

8″ 4 ply—50 ft., 75 ft., 100 ft., 125 ft., 150 ft.

Weights of Fuels

	Test	Lbs. Per Pint	Lbs. Per Gal.
Gasoline	70	.72875	5.83
Gasoline	68	.7425	5.94
Gasoline	62	.76875	6.14
Naphtha	56	.79125	6.33
Distillate	51	.81375	6.51
Kerosene	48	.82625	6.61
Kerosene	43	.84875	6.79

CONCLUSION

We have presented in this book, for your careful consideration, the line of WORTHINGTON Engines in detail. The various types are shown just as they actually appear, and described as fully as the brief space will permit.

It is difficult to present the full value of WORTHINGTON Engines in a book of this kind, or to show all the good features and points of superiority. To secure a more comprehensive idea of WORTHINGTON Engines, we ask you to compare them with engines of other makes—compare them part by part—their construction, mechanism, ability—compare every feature that enters into their general make-up.

When you make a thorough comparison of this kind, we know that your better judgment will direct you to WORTHINGTON Engines. For it is on such comparisons as these that the majority of WORTHINGTON Engines are selected.

In a WORTHINGTON Engine you buy more than a mere engine. You buy "Engine Service"—securing the utmost possible in efficiency, economy, reliability, simplicity and durability.

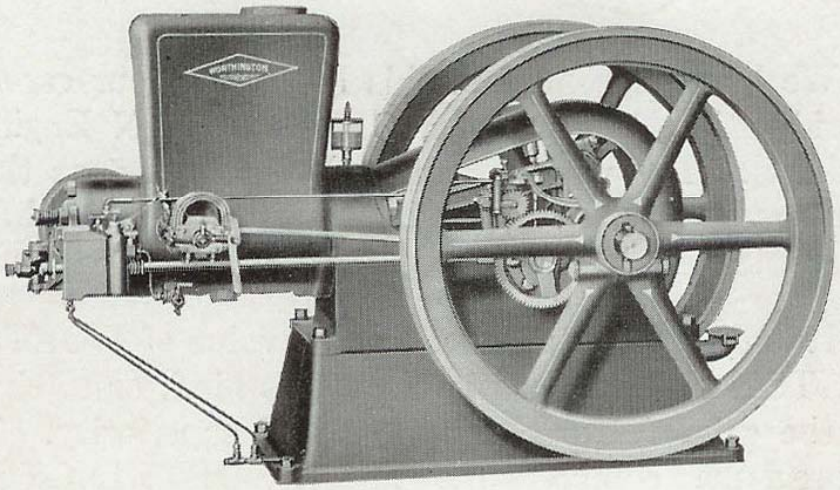
Worthington Pump and Machinery Corporation

GAS ENGINE WORKS CUDAHY, WISCONSIN

(Suburb of Milwaukee)

WORTHINGTON

Throttling Governor Kerosene Engines



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GAS ENGINE WORKS

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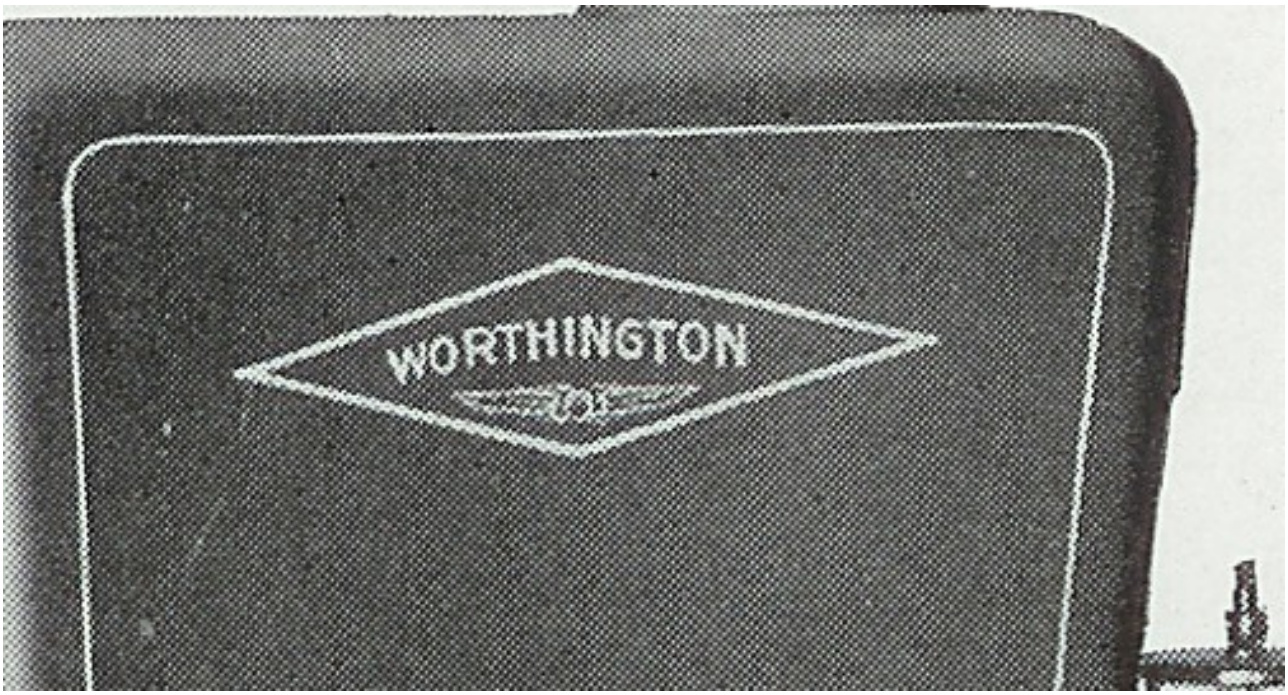

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