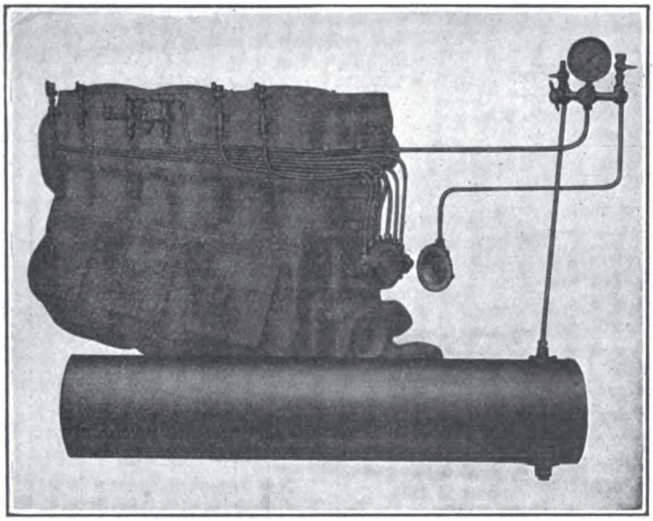
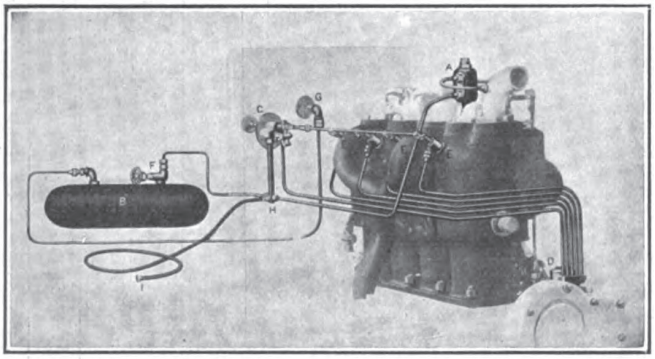
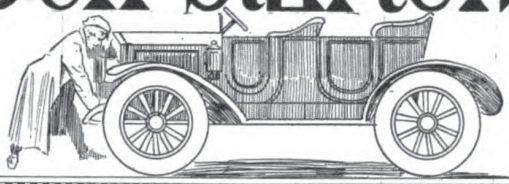


Assembly of the Winton compressed air starting system



Chalmers compressed air starter. The parts are as follows: A, check valve; B, air tank; C, push rod; D, distributer; E, cylinder valves; F, shut-off valve; G, gauge; H, tire inflator valve; I, tire connection

Self-starters



UP to a few months ago the number of automobiles which had provision for the automatic or semi-automatic starting of their motors was confined to one or two prominent makes, notably the Winton and Amplex, which have been so equipped for a number of seasons. Yet a survey of the specifications of the 1912 cars will disclose the fact that not fewer than sixty makers have included some sort of self-starter in the equipment of their cars for this year.

Although self-starters and safety starting cranks have been on the market for several years, it was not until this season that manufacturers gave them serious consideration. A general and almost unanimous awakening to the self-starter's importance as a selling factor seems to have been reached. It is only natural that in the evolution of the automobile the automatic starting device should sooner or later merit serious thought, and the wonder is that it has waited until now for this attention.

There are at present several types of motor-starting devices, which may be classed as acetylene gas, electrical, compressed air, spring and lever starters. The type which appears to have the most extensive adoption is the first-named, the acetylene gas starter. There are several reasons to which the popularity of this class of starter may be ascribed, chief among them being its low cost and the extreme ease with which it may be attached to any motor, old or new. No alterations of the existing designs of engine and immediate parts are necessary in order to add the device.

Next to acetylene gas, compressed air starters seem to have the most adherents. A distinct point in favor of this type lies in the fact that the charge admitted to the cylinders is not explosive, as in the case of the acetylene gas type. The pistons are driven down by the compressive force of the air and not by explosive force, thus doing away with any danger, however slight, which might arise from the use of acetylene in the motor. On the other hand, the high pressure which must necessarily be maintained in the air storage tank of the compressed air apparatus might be considered an objection.

Only two concerns are equipping their cars with electric starters, whereas there are several which will make use of spring devices.

A list of the cars which will be equipped with self-starters for 1912, together with the type adopted by each, follows:

Name of Car.	Type.	Name of Car.	Type.
Alpena	Explosive gas	Lion	Explosive gas
American	Explosive gas	Luverne	Explosive gas
Amplex	Compressed air	Marion	Explosive gas
Atlas	(Not available)	Marmon	Explosive gas
Austin	Compressed air	McFarlin	Compressed air
Babcock	Explosive gas	McIntyre	Explosive gas
Bergdoll	Spring	Midland	Compressed air
Berkshire	Compressed air	Moline	Explosive gas
Cadillac	Electric	Moon	Explosive gas
Case	Explosive gas	Nance	Compressed air
Chalmers	Compressed air	Otto	(Not available)
Colby	Explosive gas	Patterson	Explosive gas
Cole	Explosive gas	Peerless	Spring
Corbitt	Explosive gas	Premier	(Not available)
Duryea	Lever	Pullman	Explosive gas
Elkhart	Explosive gas	Rambler	Spring
Empire	Explosive gas	Rayfield	Spring
Everitt	Explosive gas	Regal	(Not available)
G. J. G.	Explosive gas	Republic	(Not available)
Great Western	Explosive gas	Schacht	Explosive gas
Haynes	(Not available)	Selden	Explosive gas
Herreshoff	Explosive gas	Simplex	Explosive gas
Hudson	Explosive gas	Speedwell	(Not available)
Imperial	Spring	Streator	Explosive gas
Inter-State	Electric	Stuyvesant	Spring
Jonz	(Not available)	Suburban	(Not available)
Keeton	Explosive gas	Velie	Compressed air
Kisselkar	Spring	Warren	Explosive gas
Kline Kar	Spring	Westcott	Explosive gas
Lambert	Pedal	Winton	Compressed air
Lexington	Explosive gas	Zimmerman	Lever

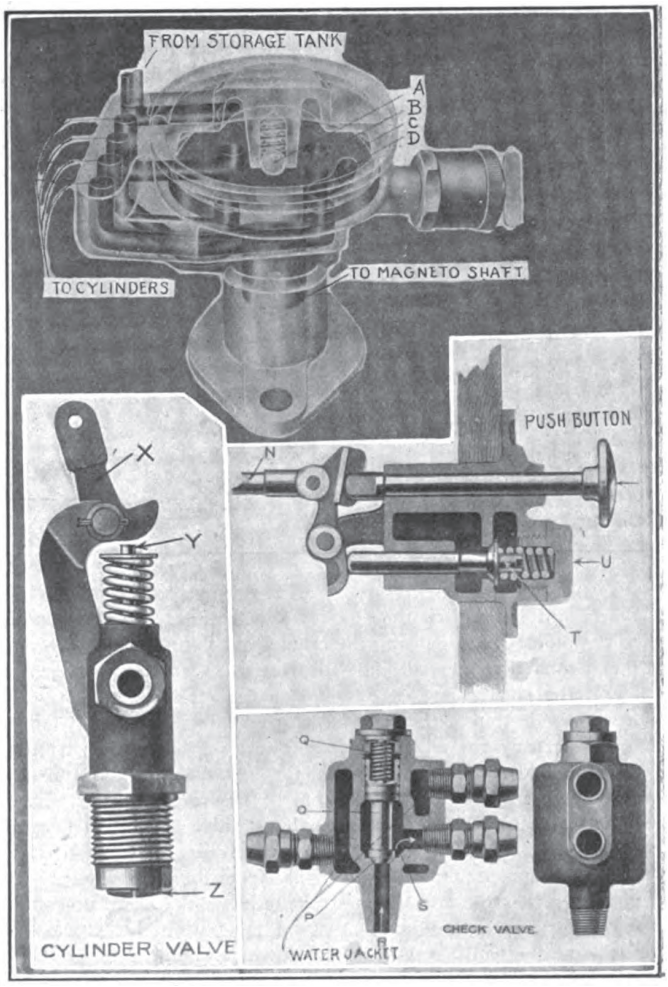
Compressed Air Starters

The Winton Self-Cranking System

For several years the Winton Motor Carriage Co., Cleveland, O., has featured a self-starting system on its cars. The principal parts of this system are the air storage tank and the distributer. The air which causes the pistons to move through their various strokes is admitted to the cylinders under pressure. During this movement of the pistons, which draws in fresh gas, the spark occurs, igniting the charge and causing the motor to begin its regular cycle of operations. The chief advantage claimed for this system is that the pistons are already under motion when the spark occurs, thus doing away with the sudden jar to the parts due to driving the pistons down violently from dead rest by starting on the spark. Attached to cylinders No. 3 and 4 are outlets through which a small portion of the pressure of each power stroke passes to the copper pressure tank carried between the left frame rail and the driving shaft of the chassis. In it the air under pressure is stored until required to start the motor.

The distributer valve is the only moving part of the system.

# of many types



DETAILS OF CHALMERS STARTER PARTS.—Top, distributer disk. Disk B revolves on magneto shaft, and is held down by ball and spring A. Air enters at C and passes through port D into the cylinder pipes as disk revolves. Center, dash push valve. Rod N connects to cylinder valves. Air to distributer passes through valve T. Nut U regulates tension of valve spring. Lower left corner, cylinder valve. To open valve Z, arm X, which is connected to rod N, presses down on rod Y. Lower right corner, check valve. Spring Q holds valve P on its seat, through rod O. Air passes to storage tank through S.

Assembled on the dash are the gauge, which shows the amount of the tank pressure; the push button, which allows the compressed air to pass from the tank to the cylinders, and the shut-off valve for use when the car is to remain long idle. This valve prevents the loss of pressure from the tank. By pressing the dash push-button air flows through the distributer to one of the cylinders. The pressure forces the pistons to move, and as a piston passes the firing point the motor starts. If for any reason the first cylinder fails to fire the distributer sends the air to the cylinder next in order to fire, and forces the next piston past the firing point, and so on, if necessary, through the series of the cylinders.

The Chalmers Starter

Like the other starters of the compressed-air type, the one which is placed on the cars made by the Chalmers Motor Co., Detroit, Mich., provides a charge of compressed air which forces down for the balance of the working stroke the piston which has stopped at the top of the compression stroke, or just beyond that point, then by means of a distributer the air supply is shut off from that cylinder at the end of the working stroke and forced into the next cylinder which is ready for this stroke. The valve which supplies the compressed air is a simple water-jacketed cast-iron check-valve located in the head of No. 1 cylinder. As the explosions occur in this cylinder, the pressure acting through the valve passage raises it, thus allowing a small amount of the combustion pressure to pass through and into the storage tank. This escapement is very slight on each combustion stroke and it ceases altogether as soon as the pressure in the storage tank balances that in the cylinder. The pressure in the former under normal conditions ranges from 100 to 150 pounds. The force by which the check-valve is held on its seat is controlled by a spring which is adjustable by a hexagonal nut at the top of the valve. The control or dash push-valve is a small, simple affair, located on the dash directly in front of the driver, so that by reaching out with his foot the push-button may be depressed. This releases the valve from its seat, allows air to flow to the distributer and at the same time operates a bar which opens the cylinder valves. Thus a passage is made from the distributer into the cylinder which is ready for the working stroke. The cylinder valves remain open as long as the dash push-valve is depressed, which is done until the motor starts.

The distributer consists of a steel disk, which is shown in the illustration. This disc is connected to the oil pump by a shaft and it revolves in a horizontal plane. In it is a slot or port and the air coming from storage tank passes through this port into the cylinder pipes which are uncovered successively as the disk revolves. Being positively geared, the action of the distributer is similar to that of a commutator, the cylinder which is ready for the working stroke receiving a supply of air at the same time as it would be fired. Except during the period of starting, the disk revolves idly on its seat, and it is held in place by a ball and spring which are controlled by a nut at the top of the distributer. The cylinder valves are of the poppet type and are held shut by stiff springs. A valve which is located just in front of the driver's seat in the floor board is provided so that the air can be shut off from the starter system when the car is to be left standing for any length of time, thus preventing leakage. A feature of the Chalmers starter is the small recess beneath the distributer disk, which recess is open to the outer air and is so placed as to uncover the port connecting with the compressed cylinder. The object of this is to relieve the compression and to allow the motor to be started with less compressed air than would otherwise be necessary. With this system a pressure of about 40 pounds is required to turn the motor over.

The Wilson Starter

This starting system is made by the Wilson Motor Starter Co., Franklin, Pa., and its distinctive feature is the air pump which is operated by gearing from the motor layshaft, camshaft or from any other moving shaft only when the gears are meshed by the operator by means of a foot engaging treadle, as illustrated. In operating the system, the driver presses button A, which, due to the lever O, raises the valve N, thus permitting air to pass from the supply tank through the line C to D and then to F of the starter proper. From here it passes through F to the back of the piston G. This forces the piston down and causes

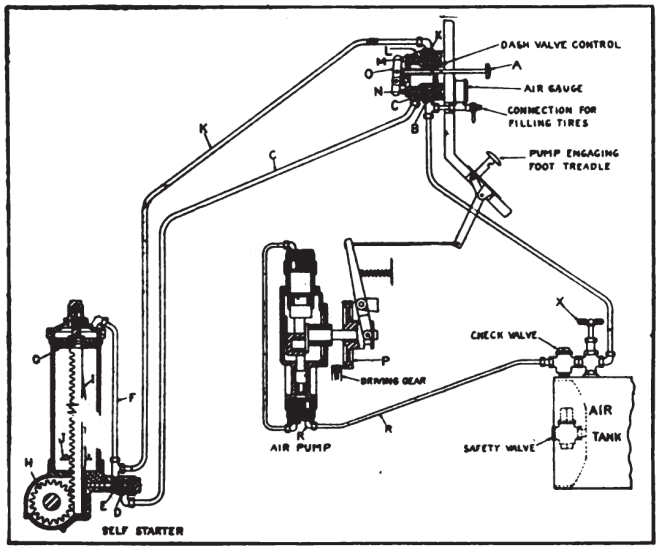
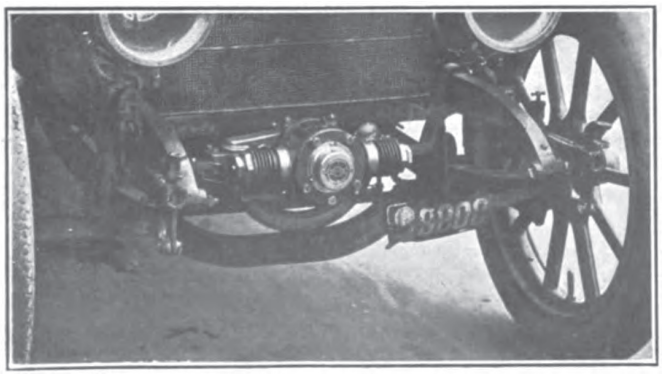


Diagram of Wilson compressed air starting apparatus

the rack I to revolve the gear H which engages with a clutch to the motor shaft, causing the crankshaft to be rotated. Due to this clutch arrangement, not illustrated, as soon as the motor starts the starter is free of same, and if the operator has released the button A the rack I returns automatically to its upper position ready for another start. The air back of the piston G is exhausted through the pipe K, through the orifice L and also through the holes J at the bottom of the piston stroke. From the construction is seen that the exhaust valve M and the supply valve N cannot be opened at the same time. The valve E in the starter proper cuts the air supply from the pipe F before the piston reaches the end of its stroke, so that the operator cannot waste air by continuing to press on the button A. In case of back-fire, the end of rack I is blank, which allows the gear to revolve free. The air pump is engaged at the will of the operator at any time the motor is running by pressing down on the pedal, which operation engages gear P with the driving gear. In from 8 to 18 minutes running of the small pump it furnishes enough air to start about thirty-five times, depending on the engine speed. Should the operator fail to stop the pump, a safety valve on the tank releases all pressure over 305 pounds.

The Amplex Self-Starter

This system is very similar to that used on the Winton, and it is placed on the Amplex cars of the Simplex Motor Car Co., Mishawaka, Ind., make. A diagram of the apparatus as used is shown in an accompanying illustration. The engine compresses the gas which is stored in the tank C. A small part of the pressure of each compression stroke passes through the check-valve A, which is located on the rear cylinder. By pressing on the push-lever B air under compression passes from the storage tank to the distributer and thence to the cylinder which is ready for its working stroke. This forces the piston down and turns the crankshaft over, the charge of gas being admitted to the other cylinders and ignition then taking place in the usual way. There is the usual check valve at each cylinder, and also a valve at the seat by means of which the air may be shut off from the system to prevent leakage. Provision is also made to prevent the pressure in the tank from reaching an excessive value.



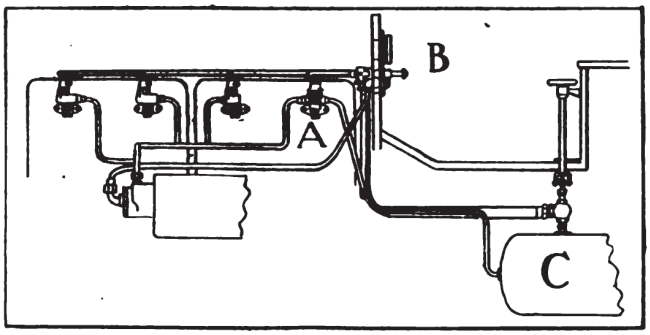
Showing Crescent starter attached to front of car

The Janney-Steinmetz System

This outfit makes use of an auxiliary two-cylinder compressor G, see diagram, which is driven from the engine by means of a positive clutch, this latter being provided so that the compressor may be put into or out of service as required. A multiple-port distributer which is shown diagrammatically at B is mounted on the compressor, and is geared so as to rotate with the motor at camshaft speed, thus sending air into the cylinder which is ready for its downward stroke and turning the motor over. A pressure gauge C is fixed on the dash and shows the condition of the air in the tank F. The foot valve D is used in starting to admit air to the distributer and from here to the proper cylinder. The system may also be arranged so that the distributer runs free from the pump. For instance, it may be mounted on the stem of the timer. A feature of the compressor is that either of its cylinders will operate separately, this being of advantage should one or the other or them get out of order for any reason. In operation the air is carried in the tank at a pressure of from 80 to 150 pounds, and the compressor will work properly at any speed ranging from 150 to 200 revolutions per minute. The Janney-Steinmetz Co., Philadelphia, Pa., is the manufacturer.

Other Compressed Air Starters

An apparatus of this kind is put out by the Start-Light Co., Chicago. There is an air storage tank, cylinder check-valves,



Amplex air starting system

pressure gauge, combined distributer and air compressor and diaphragm governor which automatically controls the pressure in the tank. When the pressure in the tank reaches a set minumum this governor causes the compressor to operate. The system is carried out in much the same manner as those already explained, starting being effected by means of a foot push-button.

The Crescent Air System Co., Detroit, also makes an air starter of peculiar form. A metal frame is attached to the car just in front of the radiator. On this frame a brass cylinder of crescent shape is mounted. Contained in this cylinder is a curved piston rod, having its piston on one end, the other being attached to an arm. This arm or crank is fulcrumed on a hollow shaft through which the engine shaft operates. A pawl on the arm engages and turns a ratchet on the crankshaft, thus revolving the crankshaft when a supply of air is admitted to the cylinder. Included in the outfit are an air tank and compressor. The admission of air to the cylinder is controlled in the usual way by a device easily accessible from the driver's seat.

One of the cleverest of the starting apparatuses lately brought out is that of the Artizan Brass Co., Chicago. The crankshaft is turned over two or three times by an impulse received from an arrangement of cylinder and piston connected to an automatic clutch. The piston of the cylinder is driven down by compressed air which is admitted when starting of the

motor is desired. The air is compressed by a small compressor placed on the back of the frame of the car. The cylinder part of this compressor is attached to the axle, while the piston is fixed to the chassis above it. Each vibration of the car forces this piston down, thus sending air through a check valve into the storage tank, which is located at any convenient point on the car frame.

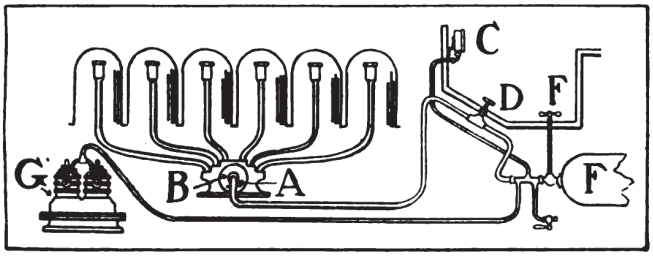
The new Velie models produced by the Velie Motor Vehicle Co., of Moline, Ill., will be equipped with compressed-air starters, the principle of operation being the same as that of the Chalmers. The air is stored in a tank under a 150-pound pressure, this pressure being produced by means of large plunger valves which are operated by power from each compression stroke. The distributer admits the air to the cylinders in the usual way in their regular order of firing, and the crankshaft is turned over by this means until the engine takes up its cycle of operations under its own power.

Explosive Gas Starters

The Disco Acetylene Starter

The starter of this name is made by the Ignition Starter Co., Detroit, Mich. It is simply a device which enables the operator to inject a small amount of gas into each of the cylinders of his engine, which gas forms an explosive mixture only when mixed with the air in the cylinders. This mixture is ignited by the spark in the usual way, thereby putting the motor in motion and making it pick up its regular cycle of operation. The Disco is a high-pressure system, the charge being sent to the cylinders under the pressure of the ordinary acetylene tank.

Its construction is very simple, as may be seen from the illustration. The handle which connects with the distributer is the only part with which the driver is concerned when starting the

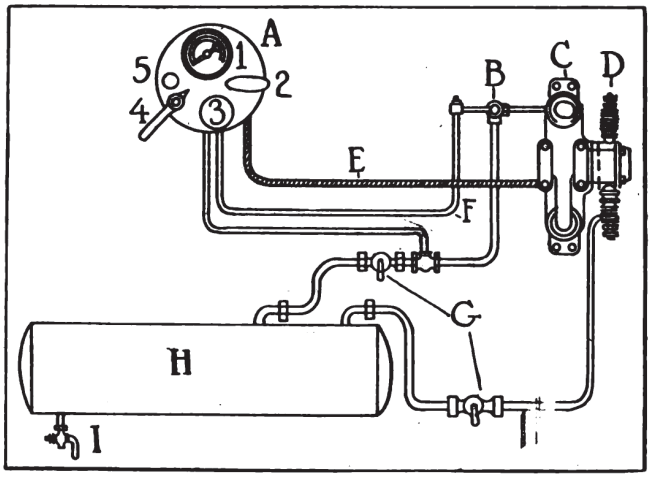


Janney-Steinmetz compressed air apparatus, showing two-cylinder auxiliary air compressor

car. From the gas tank a two-way connection permits of the use of the same gas for lighting the headlights as for starting the motor. From the connection S a pipe leads to the distributer at K, while the headlights are supplied through L. From the distributer the gas is piped to each of the cylinders, being introduced into them through the special valves shown at C-1-2-3-4. The needle point shown on the distributer is provided so that adjustment of the amount of gas admitted to the cylinders when the handle is turned over is possible. The distributer handle is made so as to be easily removable so that when the car is in a garage the owner may prevent tampering with the starting device. One turn of the distributer handle is sufficient to charge the cylinders when the gas tank pressure is above 70 pounds. Below this pressure it is sometimes necessary to give the handle more than one turn. After injecting the charge into the cylinders in this way the spark is turned on, thus igniting the explosive mixture and starting the motor. The makers state that with careful operation one gas tank can be used to start the motor about 6,000 times. The Disco is to be included as part of the regular equipment for 1912 of the Hudson, Everitt, Moon, Westcott, Colby and Pullman cars, and as optional equipment on the Selden.

The Prest-O-Starter

This starter also operates by charging the cylinders with an explosive mixture of acetylene gas and air and igniting the

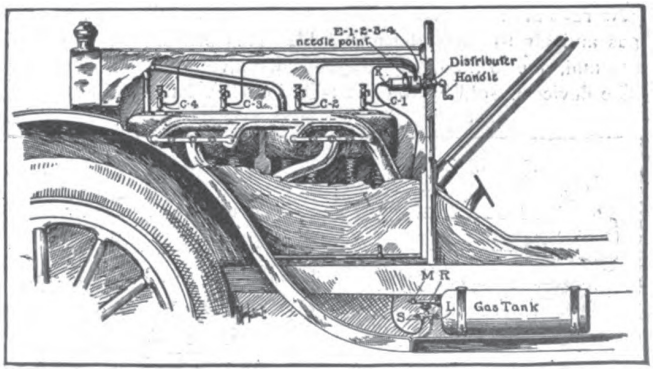


Crescent air system. A, dash plate; B, controller; C, air crank; D, compressor; E, cable; F, rod; G, shut-off valves; H, air tank; I, drain; 1, gauge; 2, compressor button; 3, air crank button; 4, tire valve; 5, tire hose valve.

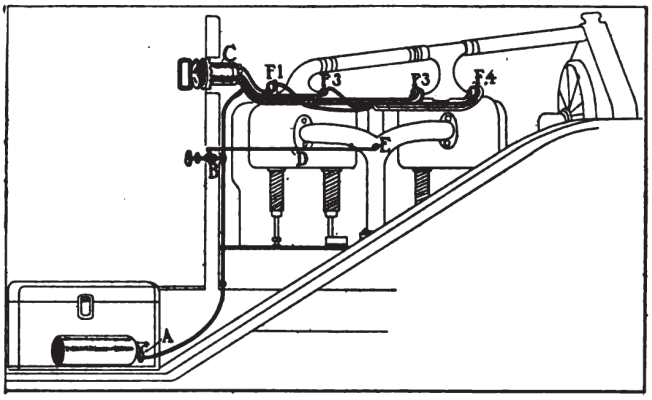
charge in the usual way. It is manufactured by the Presto-O-Lite Co., Indianapolis, Ind. Unlike the Disco, this is really a low-pressure starter, and the charge which is admitted to the cylinders is sent to them by means of pumps. The pressure of the gas in the starter is 2 ounces, this reduction from the high pressure in the gas tank being accomplished by means of the reducing valve A. The multiple pump is shown at C in the illustration. The gas is piped from the reducing valve to this pump, which is really four small ones (or six for a six-cylinder motor), and then to the cylinder check valves F-1-2-3-4. The handle of the pump P appears on the dash and corresponds to the crank of the Disco outfit. Each of the small pumps which go to make up the multiple pump P has a ball check-valve, while there are also check-valves at each of the cylinders. This multiplicity of check-valves effectively prevents the explosive pressure from reaching the pumps. A special feature of the system is the auxiliary pipe D which leads from the main pipe through the by-pass valve B to the intake manifold at E. The object of this is to provide a means of running the motor on acetylene gas for a few moments in order to allow a gasoline mixture to be formed in case it has not been produced in sufficient amount to run the motor after the crankshaft has been turned over several times by the starter. This is particularly advantageous in cold weather when the proper explosive gasoline charge is slow to form. Ordinarily, to start the motor, the handle of the multiple pump is pulled out and pressed in again one or two times, thus changing the cylinders, after which this charge is ignited by switching on the electric current.

The American Acetylene Engine Starter

The principal of this starter, which is produced by the American Starter and Carbureter Manufacturing Co., Chicago, is very much the same as that of the two explosive starters already



Disco acetylene gas engine starter.



Showing Prest-O-Starter attached to motor

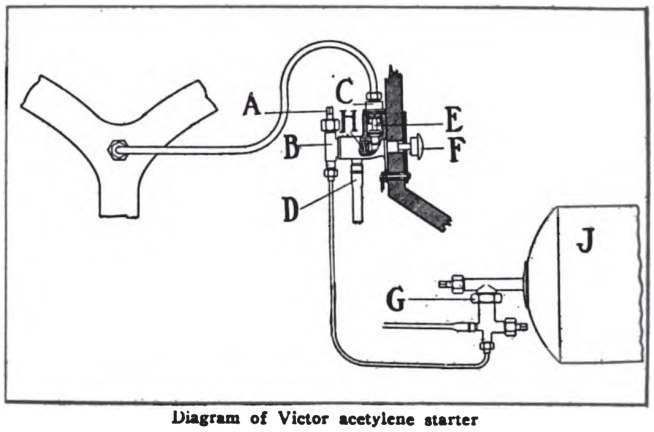
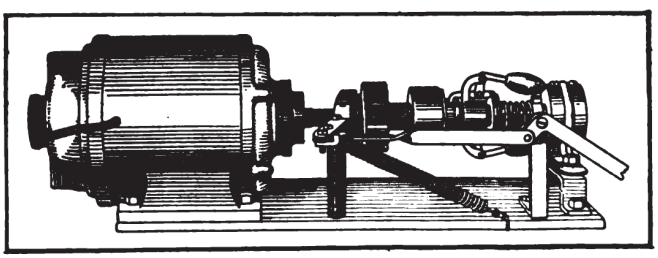


Diagram of Victor acetylene starter

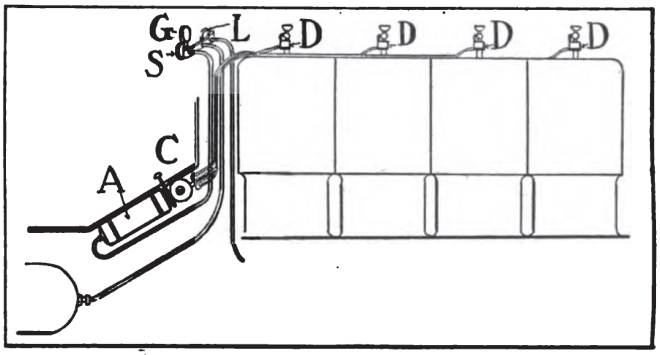
described. The charge is introduced into the cylinders through the priming cocks and it is a mixture of gas and air, the gas coming from the ordinary gas tank. Besides this tank, an auxiliary tank is placed under the footboard. The gas is piped from the regular tank to the controller on the dash, from which one pipe leads to the headlights, while another passes to the auxiliary tank, the flow to each of these sources being controlled by valves. To operate, the starter valve is turned on until the gauge indicates a pressure of 30 pounds, when a push-rod is pressed with the foot. This allows gas from the auxiliary tank to flow through a needle valve to the pipes which lead to the cylinders. The check-valves, through which the gas passes into the cylinders, prevent the loss of any of the compression. By the injection of several charges it is claimed that the starter will operate satisfactorily on as low a tank pressure as 5 pounds. The starter is included in the standard equipment of this year's Case cars.

The Victor Starter

The Victor starter operates on the principle that during the last few strokes of the motor upon stopping, a proper mixture of acetylene gas and air is admitted to the cylinders. The motor is then started on the spark at such later time as desired. The gas which is admitted to the cylinders being fixed, it is unaffected by variations of temperature, humidity or barometric pressure, which makes it possible to store it in the cylinders ready for later spark starting. Referring to the diagram, the ordinary acetylene gas tank is shown at J and from it the gas for starting passes through the two-way valve G to the valve B, only when the button F on the dash is pressed. This button is held so that the valve is closed when not in use by the spring H. Admission of the gas through B forces the valve E up, thus allowing the gas to pass through C and into the intake manifold. The valve A is provided to permit of the regulation of the amount of gas admitted to the intake manifold when F is pressed. At B the gas is mixed with air entering through D, which is connected with the outside air by a rubber tube passing to the side of the bonnet. Until the motor slows down to the last few revolutions pressure on the dash foot rod F will not allow gas and air to enter the manifold. This prevents the waste of gas and, due to the design of the flow valve, prevents back firing. The device is sold by the Start-O Co., Cleveland, Ohio.



O'Neill electric system, showing centrifugal governor



American starter. A, compression tank; C, pedal on floor board; D, cylinder check valves; G, gauge; L, valve controlling lights; S, valve controlling starter

The Instantaneous Starter

The Instantaneous Auto Starter Co., of Cincinnati, O., is manufacturing what they term a cold weather auto starter. It utilizes the gas from the acetylene gas tank, introducing it into the intake manifold. The device is not intended to start the engine from the seat, it being necessary to turn on the acetylene gas in the same manner as if using it for lighting the lamps. There is a rubber bulb between a starter valve and the gas tank valve. In starting, this bulb is pressed until all air is out of the piping between the starter valve and the tank valve. This produces a suction when released, and the tank valve is then slowly opened and enough gas is allowed to flow from the tank into the bulb to fill it. The flow of gas from the acetylene tank is stopped before the starter valve is opened to admit the gas into the manifold. The charge being admitted to the cylinders, it is exploded by the spark to start the engine. Should no one of the cylinders be ready for its working stroke, it is necessary to give the motor a quarter turn with the crank.

The A. A. Starter

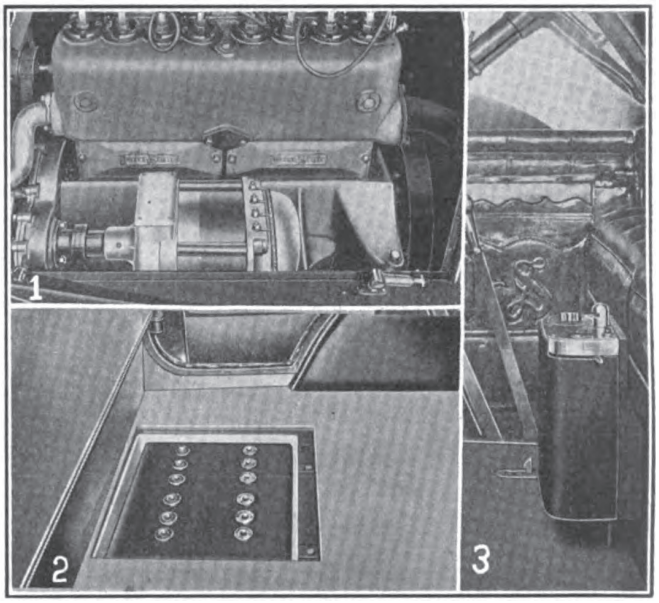
The starter of this name is put out by the Auto Appliance Co., Akron, Ohio. It can be applied to any motor which is equipped with a dual ignition system. While it is an internal combustion starting device, it introduces through a pump firing charges of gas and air into the cylinders instead of pure gas. This is accomplished by means of a revolving disk having a single port hole. In the head of the pump barrel there are also as many port holes as there are cylinders, and the gas is distributed to the cylinders through these holes when each of them in turn registers with the opening in the disk. The gas is held in check by means of a special form of valve located at the tank. When a pedal, which is accessible from the driver's seat, is released from a holding dog, it is forced in automatically by a spring. This allows gas to pass through a positive regulating needle valve into the pump barrel, the dimensions of which are 2 3-4 inches by 6 inches. Here the entering gas is mixed with

air which enters through a ball-check valve. On the forward stroke of the pedal the mixture is forced into one of the cylinders, through the action of the revolving disk. In order to charge the entire motor it is necessary to force the piston forward as many times as there are cylinders. For use in extremely cold weather a by-pass is provided. It can be opened after the motor has been charged in the usual way, thus allowing pure acetylene gas to enter the intake manifold where it is mixed with the air which has passed through the carbureter. This produces a mixture which will keep the motor running until a sufficient amount of gasoline can be brought up from the carbureter.

Electric Starters

The Delco Electric Starter

This electric system, which is the product of the Dayton Engineering Laboratories Co., Dayton, O., is used for ignition and lighting as well as for starting the motor. It is a part of the regular equipment of all Cadillac cars for 1912. The chief parts are the motor generator, storage battery, automatic cut-out device, regulator and control switches. The motor-generator operates either as a motor or generator, depending on whether it is being used for starting or for igniting the charges and lighting the lamps. For starting the engine the generator is temporarily and automatically transformed into a motor, the current required to operate it as such being furnished by the storage battery. The operator, after taking his seat in the car, presses a button and pushes forward on the clutch pedal. This automatically engages a gear of the electric motor with gear teeth in the periphery of the flywheel of the engine, causing the latter to rotate. As soon as the engine takes in charges of gas from the carbureter and commences to run on its own power, the operator releases the pressure on the clutch pedal, the electric motor gear disengages its connection with the flywheel, and the car is ready to be driven. The electric motor then again becomes a generator and its energy is devoted to ignition and to charging the storage battery. This latter has a capacity of 80 ampere-hours, and as soon as this capacity is reached the charging automatically ceases.

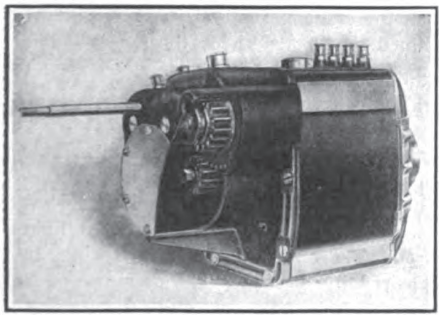


Aplco combined electric starting and lighting system. 1. View showing motor-generator installed. 2. Storage battery is located under floor of tonneau. 3. Controller box on front seat

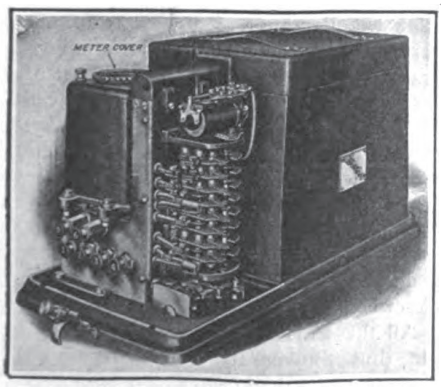
The battery is of sufficient capacity to rotate the crankshaft for about 20 minutes if necessary.

The Aplco Electric Starting System

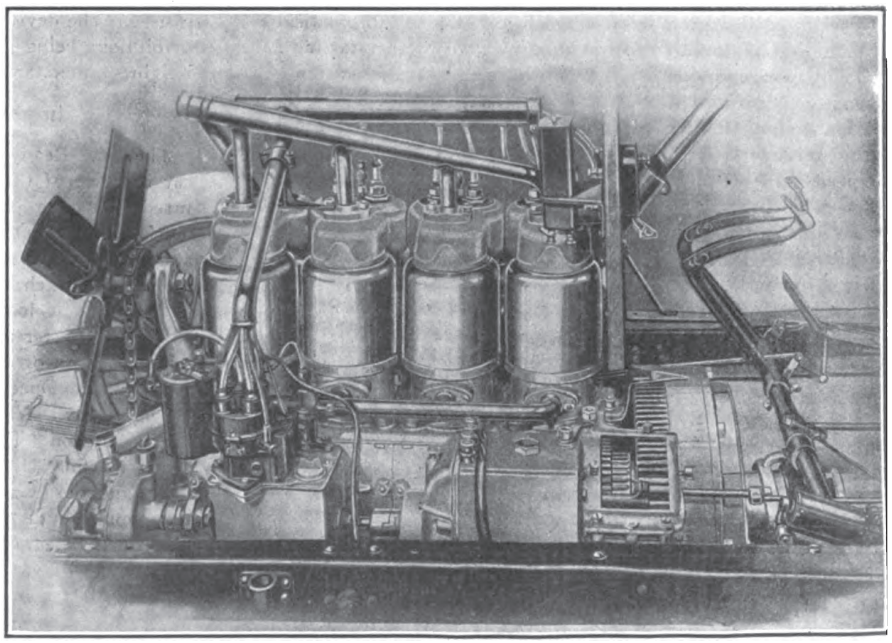
The Apple Electric Co., Dayton, O., is also putting an electric starting system on the market. It does not differ materially from the Delco, and the combined motor and generator together with controller and storage battery are also present. The motor-generator is driven from the crankshaft or propeller shaft in any convenient way, either by gears or chain. The front part of the housing of this motor-generator contains reducing gear mechanism and also the automatic clutches which serve to release these



Delco motor-generator

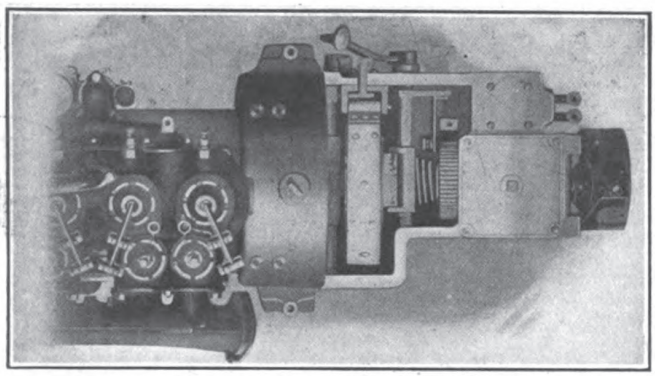


Delco controller and storage battery



THE APPLICATION OF THE DELCO ELECTRIC STARTING, LIGHTING AND IGNITION SYSTEM TO THE 1912 CADILLAC CAR.

The magneto distributer and distributer coil are at the left, while the motor-generator is placed a little to the right of the center, so that its gear will mesh with the teeth cut on the periphery of the flywheel. The edges of the teeth are rounded much the same as those of transmission gears to permit of easy engagement. The battery box, which carries with it the regulating meter and controlling switch, are not seen, being carried on the dash. The storage battery has a capacity of 80 ampere-hours



Gardner automatic engine starter, showing its installation between motor and transmission, and its adaptation to unit power plant construction

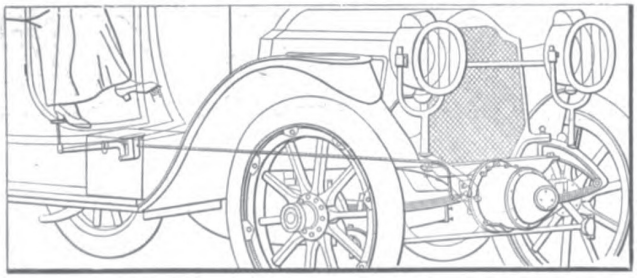
reducing gears as soon as the motor is running under its own power. To start the motor, a small lever on the controller is pulled. This sets the starting motor in operation, causing it to draw current from the storage battery, and to turn the crankshaft in the usual way. No part of the apparatus is placed on the dash, the controller being put on a panel under the driver's seat. The apparatus is so interlocked that it is impossible to operate the starting mechanism until the spark has been retarded and the gear shift lever is in the neutral position. The motor-generator is 18 inches in length by 7 1-4 inches in diameter and weighs about 70 pounds

The O'Neill System

This system consists of vaporizing the gasoline within the carbureter, releasing the compression, rapidly spinning the motor, and thus producing suction, compression and ignition by electrical means. The system is carried out by the use of an electric generator in connection with special storage batteries which float on the line, automatic governors controlled by magnetic and centrifugal force, and gear transmission between the flywheel and the driving pinion on the generator shaft. For starting duty, the motor-generator runs as a motor, and for lighting or battery charging it operates as a generator, as in the Delco system. The accumulators or storage batteries are charged in multiple and discharged in series, this change being effected automatically by a multi-pole, double-throw switch operated by the starting pedal. The vaporizer used within the carbureter is at the bottom of the float chamber and it consists of an electric button about the size of a dollar. In it is a high resistance which heats the gasoline and serves to vaporize it when the current is on. The generator speed, and hence its output, is kept constant regardless of the speed of the car by means of the centrifugal governor seen in the illustration. The system may be geared to the flywheel or it may be friction-driven, but in either case the drive is mounted on a loose sleeve that fits over the armature shaft, to which the governor, with cone clutch fitted thereto, is feather-keyed. A pedal on the foot board controls the whole series of operations involved in starting.

The Elba Electric System

The Willard Storage Battery Co., Cleveland, O., makers of the Elba line, are also putting out a combined self-starting and electric lighting system. The battery with this outfit is a 12-volt affair, producing a starting effort of 300 foot-pounds in connection with a motor weighing 35 pounds. The gear ratio between the motor and the engine crankshaft is 18 to 1. In other respects the system does not vary materially from the electric systems already mentioned.

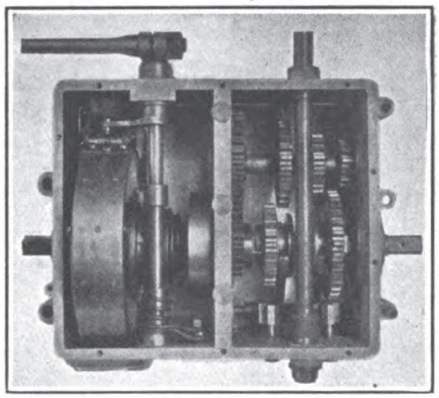


Attachment of the Ever-Ready starter to front of machine

Spring Starters

The Gardner Automatic Engine Starter

This device, which is the product of the Gardner Engine Starter Co., Chicago, is unique in that it is purely mechanical and is a gearless control of stored energy secured from the momentum of the car through the rear axle and drive shaft. On the propeller shaft is mounted a brake drum within which is a compound concentric spring. The device is located preferably between the flywheel and the gearbox, as illustrated. It is designed with the idea of being made an integral part of the car; and for this reason is not adaptable to old machines unless they have unit power plants, for which type of construction a special case for the device is provided, thus affording a means of bolting it to the engine housing. The brake band is actuated by the clutch pedal, which also provides the car with a powerful transmission and clutch brake. The spring is wound and unwound in the same direction, which dispenses with gears and idlers, as no reverse motion occurs. It is very long, this being possible within the small space provided because it is at all times under high tension and only one-quarter of the full wind is used. The device whirls the crankshaft rapidly, the number of revolutions being determined by the length of the spring. The weight of the starter complete is about 45 pounds.



Gardner starter installed in same case with transmission gears

The Ever-Ready Automatic Starter

The Ever-Ready starter, which is attached to the front of the car in place of the ordinary starting crank, has been manufactured for some years by the American Ever-Ready Co., New York. It is about the size of an ordinary automobile headlight and looks like one reversed. There are two powerful springs in the device which are released by a very slight pressure on a pedal which is located near the driver's seat. The illustration shows the starter in use. When released the springs revolve the crankshaft six or eight times at a speed of about 300 revolutions per minute. Once the engine is running it rewinds the device automatically. When wound it disengages and is ready for the next operation. The starter will start the motor if it is in condition to run. However, if for any reason the engine is out of order and the device unwinds without starting it the former can be rewound by hand. This is made safe and easy to do by a set of reducing gears. The company makes three sizes of starters for engines of various horsepowers.

The Elder Starter

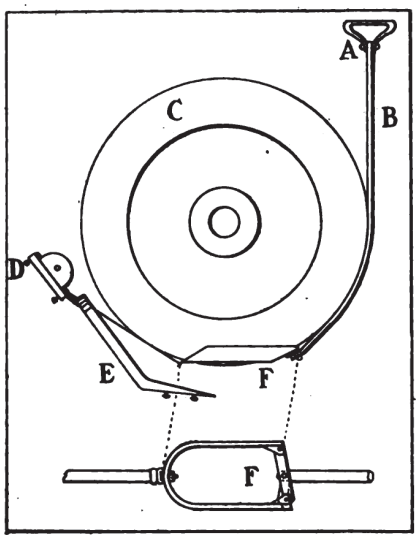
This starter, which is produced by the Elder Manufacturing Co., Indianapolis, Ind., does not differ a great deal from the spring devices already described. The starter is in the shape of a drum with flat ends. All the working parts are inclosed in a housing which is oil tight, thus allowing the gears to run in oil. The drum can be placed in front of the radiator or behind it, or it may be placed under the front seat by extending the drive

shaft. After the motor spring is wound, the device is ready to start the engine. Pressure on a foot lever connects the starter to the engine, at the same time tripping the spring. In unwinding this spring rotates the crankshaft in the usual way, turning it over 8 or 10 times. As soon as the engine starts the spring is rewound to a certain tension when the two are disconnected automatically, leaving the starter in readiness for the next start. During the rewinding operation the drum turns once to each 15 turns of the crankshaft. The device is so constructed that back-firing will not damage it.

Lever and Pedal Starters

The Star Starter

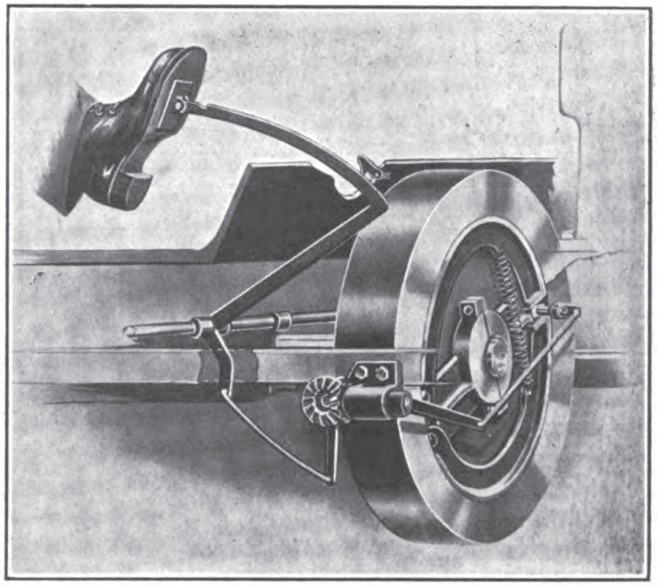
This device is put out by the Star Starter Co., Rochester, N. Y. It serves to start the car from the driver's seat by means of a lever, and it contains in its construction a safety feature protecting the operator from the ill effects of back-firing. The starter proper is attached to the crankshaft, the starting crank first having been removed. A short shaft is furnished which engages with the clutch on the countershaft and the starter is lined up with it. A chain running over a disc passes through a pulley at the corner of the hood. Here it is attached to a rod which is connected to a lever at the driver's seat. A four-way clutch fitted to the crankshaft prevents the danger of a kick. When the lever is pulled, the crank is spun just as if the hand crank were used, while the spiral spring disengages the starting device and brings it back into position. Referring to the illustration, the safety clutch for guarding against back-fire is shown at D. The spring B is wound around the main shaft C, the adjusting nuts A being used to regulate the tension in this spring, which serves to counteract the initial compression of the motor. The entire front part of the starter is enclosed by a dust-proof cap N, which is fastened to the chain pulley F by means of the lock stud E. The starter frame G is pinned to the pulley F, and when the latter is turned, the engagement of the dogs H and ratchet K causes the shaft M connecting between the crankshaft and starter shaft to be turned. In the event of a back-kick the dogs will prevent the ratchet from reversing its motion. Also, after the motor has been started, these dogs are thrown out of engagement with the ratchet, and hence with the starter, by centrifugal force.



Kimball starter which grips the flywheel and permits the turning of the crankshaft from the seat thus starting the motor.

The Glenard Starter

The National Motor Device Co., Chicago, is marketing the device of this name. It consists of a 12-inch frictional clutch which is made up of two expanding rims. The width of these gripping rims is 1 inch and they are mounted on a guide or hanger attached to the crankcase bearing. The starter operates either in the flange of, or on the face of the flywheel. The frictional clutch works in a steel drum in connection with gears having a ratio of 9 to 14. These gears are mounted on roller-bearings and they are connected by levers to the pedal. Pressure on this pedal causes the expansion of the clutch by means of these gears and


Details of construction of the Glenard lever starter, which is attached to the flywheel

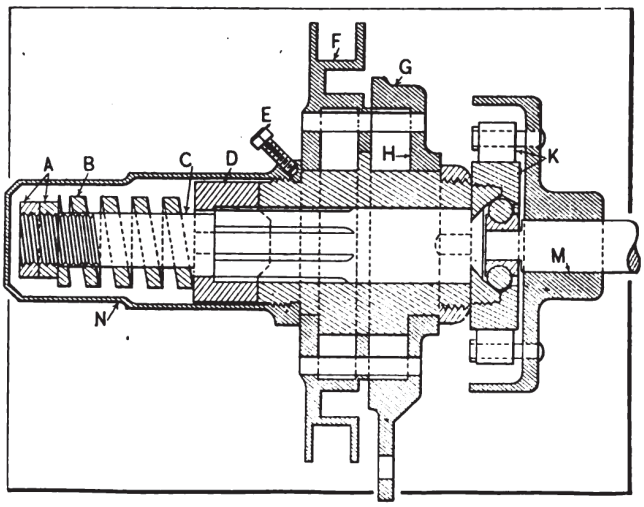
link connections. This expansion forces the clutch to grip the drum, and further pressure then pulls the crankshaft over. Obviously, the greater the foot pressure, the harder the clutch grips and the more certain its action. Should the motor back-fire, the clutch releases automatically. The device is very light and simple of construction and is adaptable to any motor having its flywheel in the rear.

The Kimball Starter

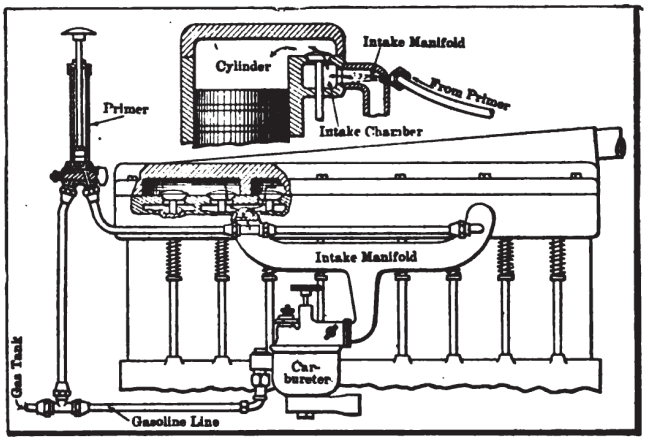
The device recently put out by the Kimball Tire Case Co., Council Bluffs, Ia., is a very simple affair for turning the motor over by hand without leaving the seat. The main feature of this starter is the clamp F shown in the illustration. By means of a combination of levers this clamp grips the rim of the flywheel C. By pulling on the handle A which comes up through the floor of the car and which is connected to the strap B the clamp tightens up on the flywheel, thus turning the engine over. As the engine starts the clamp loosens and is pulled back into its original position in the guard E by means of the spring D. The weight of the entire appliance is about 5 pounds.

The Wilkinson Motor Starter

This apparatus simply substitutes the pedal for the hand crank, and by a system of reciprocating levers enables the driver to start the car much easier than by the use of the hand crank. It



Star Safety starting device

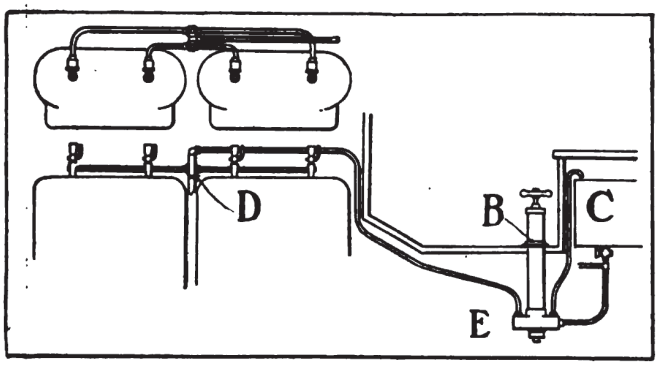


K-E-W motor primer, which injects an explosive mixture into the intake chambers

is put out by the Brown & Murray Co., Detroit, Mich. Four studs are inserted in the side of the flywheel and a pedal is located so that the operator while sitting in the seat of the car can press down upon it, thus bringing a thrusting finger into engagement with one of the four studs. The continuation of the foot pressure causes the flywheel to pass through a half-revolution and finishing the stroke past the ignition point of the most retarded spark. This happens except when the movement is arrested by an advanced spark or other pre-ignition which would cause the motor to rotate backward. In this case the contact between the thrusting finger and the stud would be instantly released, due to the action of an eccentric pawl or idling dog, one end of which is pivoted to the thrusting finger, while the other end drags loosely about the concentric surface. The purpose of the idling dog is to govern the course of the engaging end of the thrusting finger, causing it to travel in an outside radius as it advances, and in an inner radius as it retracts. Whether the motor reverses at the beginning of the stroke, the finish of the stroke, or at any intermediate point the contact is immediately broken thereby averting possible injury to the mechanism or driver from back-fire. When the pedal is not in use for starting the motor, the device is at rest, as it is mounted stationary, and has no contact with any of the moving parts of the motor. In the mechanical construction of the device two levers are so arranged as to impart greatest power at the time the resistance is greatest, thus equalizing the amount of power required to start the engine.

Primers and Starters

Cylinder primers are all operated along very much the same lines, the fuel being injected either into the cylinders themselves through special priming cocks or into the intake manifolds. A hand-operated pump is ordinarily used to draw the gasoline from the supply tank or feed pipe. The primer made by the North East Electric Co., Rochester, N. Y., is illustrated. The pump B acts as a suction pump to draw the gasoline from the supply into a mixing chamber E which is combined with the pump. After the charge has been brought into the pump the latter acts as a force pump to send it to the rotary distributer D, from which it is directed to the cylinder ready for its down stroke.

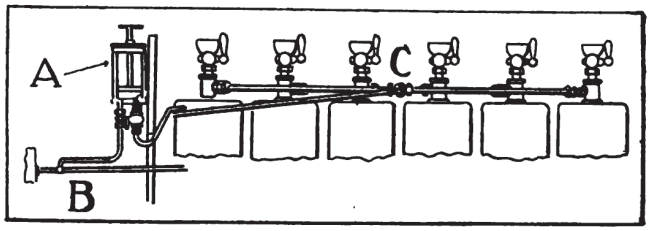


Arrangement of North East primer

Another primer which has recently been brought out is the K-E-W, manufactured by the K-E-W Mfg. Co., New York City. The gasoline is brought into the primer cylinder from the carbureter supply pipe. It is then forced into the intake manifold through a special form of spray nozzle. An upward stroke of the handle fills the primer cylinder, and a downward stroke forces it into the valve chambers of the motor.

Similar to the North East priming device is that of the Reagan Grate Bar Co., Philadelphia, Pa. In this case the pump A is located on the dash. The gasoline is drawn from the pipe at B and, by means of the pump, is forced into the distributer C, which directs it to the proper cylinder.

There are a number of other makes of various forms of starting apparatus, the details of which are not available. Among these are the Briggs & Stratton Co., Milwaukee, Wis.; The Dean Electric Co., Elyria, O.; Motor Devices Mfg. Co., La Crosse, Wis.; The Home Light Co., Chicago; The Motor Starting Co., Indianapolis, Ind.; Lockwood-Ash Motor Co., Jackson, Mich.; Wordy Self-Starter Co., Chicago; Manzel Bros. Co.,



Regan primer, showing pump on dash

Buffalo, N. Y.; Geisler Bros. Storage Battery Co., New York; Blessed Mfg. Co., Detroit, Mich., and the Pneumatic Clutch Motor Co., Los Angeles, Cal.

A Law Which Fails.—It has long been known that the law of Mariotte, according to which the volume of a gas is reduced in proportion to the pressure to which it is subjected, is not strictly correct. In the case of oxygen, the need of determining the exact amount of this gas supplied from a pressure tank for a given job of autogenous welding has brought to public attention that the deviations from the law of Mariotte become very marked as soon as a pressure of 135 kilogrammes per square centimeter is approached—which is about the initial pressure in supply tanks—the volume being in reality considerably smaller than it should be according to the manometer pressure gauge. Measurements of the gas used from such a tank, if they were based on figuring its contents from the gauge readings, would give errors averaging 6 to 7 per cent. This was confirmed at a recent contest of a number of acetylene welding apparatuses held under the auspices of the French Union de la Soudure Autogène. A series of measurements gave the first column of figures in the appended table according to Mariotte, the second column by exact weighing of the tank and its contents at the various pressures and the third column according to a curve diagram compiled from data placed at the disposal of the judges of the contest by a physicist, after extensive experiments by the latter, and serving to convert direct gauge readings into true volumes. The close correspondence between the second and third columns preclude errors in the manometer used.

Volumes according to Mariotte.	Volumes according to loss of weight.	Volumes according to corrective curve.
159.2	164.4	165
167.9	169.6	170
196	210.2	210
236.7	250.7	250
356	381	380.5

—From *Revue de la Soudu e Autogène*, November.