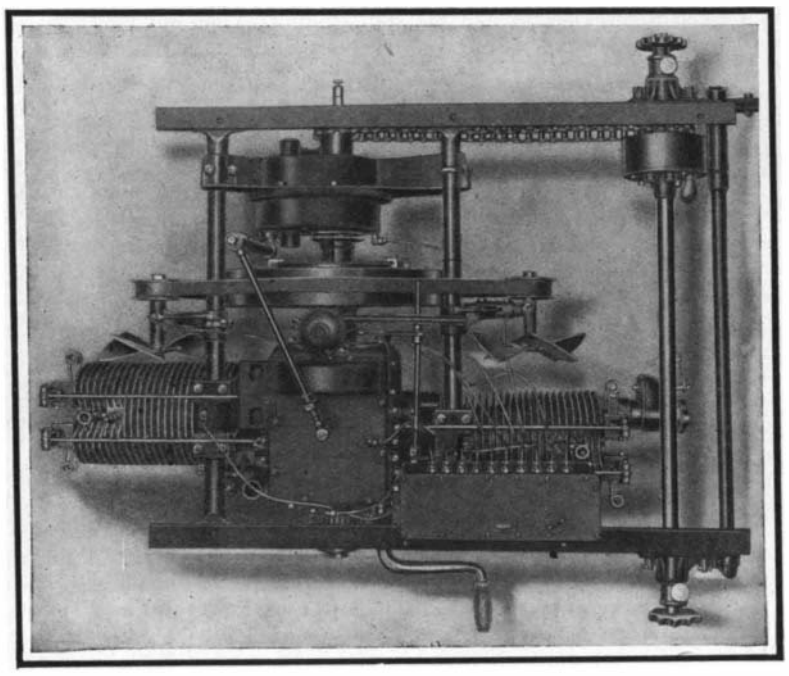
IMPROVED FORMS OF THE BUGGY-TYPE AUTOMOBILE.

The modern motor buggy is an example of reversion to an original form, as can be seen by comparing photographs of some of the machines herewith illustrated with those of the Selden car, shown on another page. The pioneer automobile builders generally sought to place a motor upon a horse-drawn vehicle, and thus make it self-propelled, and as horse-drawn vehicles generally had large wheels, these were also used upon the first American automobiles, such as those produced by Haynes and Duryea.

Some six or eight years ago Mr. Holsman, of Chicago, reverted to the old scheme of applying a motor to a high-wheeled buggy. The machine had novel features, such as a rope drive, compact power plant, etc., and it showed itself capable of traveling over extremely bad and muddy roads with considerable facility. The use of solid rubber tires did away with all tire trouble, and in the hands of the actual user these machines gave thorough satisfaction. They were gradually improved in details and the latest change has been the substitution of a four-cylinder opposed-type motor of novel design for the double-opposed-cylinder motor that has heretofore been used. A partially-sectioned plan view of this motor is shown below. The opposed pistons in each pair of cylinders are rigidly connected, the frame that unites them having a vertical slot in which is mounted a roller bearing. An eccentric disk on the motor shaft (which takes the place of the crank) fits in this roller bearing, and the back-and-forth horizontal movement of the pistons rotates the eccentric and thus the motor shaft of which it forms a part. The up-and-down movement of the eccentric is allowed for by the roller rolling up one side of the slot in the piston-connecting frame, and down the other. There is a clearance of 1/1000 of an inch between the slot and the roller, so that it clears on the side of the slot at which there is no pressure while moving up or down the other side. The motor shaft is mounted on ball bearings and is extended outward on either side of the carriage body. At and near each end there are two V-shaped pulleys. The outermost one presses against the tires of the rear wheels and reverses the vehicle when the motor is swung backward on its two hangers. The other pulleys near each end of the motor shaft drive the rear wheels by means of a special new form of friction chain which runs over large sheaves on the rear wheels. For the low speed a positive drive is obtained by spreading the driving pulleys and allowing the chain to fall on a small sprocket at the center of each one. This is an extremely novel feature and is an excellent one, as it gives a practically positive drive on the low speed which sometimes has to be used in pulling the vehicle out of a hole. Another novel feature of this new motor is the drawing of the charge of gas into the crank case, whence it passes through automatic inlet valves in the heads of the pistons into the cylinders. By dissolving the lubricating oil in the gasoline, all the working parts of the motor are thoroughly lubricated as the charge is drawn into the crank case. The exhaust valves are located in flanged chambers on the sides of the cylinders and are operated by a slotted cam on the motor shaft, thus dispensing with all cam gears. The exhaust passes through a pipe into a muffler which surrounds the motor shaft and is entirely separated from it. The new motor has a bore and stroke of 4 inches and is rated at 26 horse-power. It is of the air-cooled type, which is the type usually employed in this class of machine on account of its simplicity and economy. It is mounted under the center of the vehicle body and is readily accessible by taking up the floor. The success that attended the Holsman machine caused others to take up the manufacture of this type of automobile, and there are at the present time fully half a hundred makers of high-wheeled buggy-type automobiles throughout the United States. Most of these conform more or less closely to the lines laid down by Holsman, though there are some variations in the form of drive and of motor used. For instance, in the McIntyre machine, and also in the International, the double-opposed air-cooled motor has a planetary two-speed transmission mounted directly upon the crankshaft and arranged to drive a countershaft, placed at the rear, by means of a single chain. The final drive to the rear wheels is by double chains from the ends of this countershaft. A good idea of this arrangement is to be had from the plan view of the power plant of the International automobile buggy. In this case special fans are arranged to blow upon the exhaust valve chambers and keep them well cooled, while the lubrication is effected by means of a mechanical oiler positively driven from the motor crankshaft. A powerful 5 x 5 opposed-cylinder motor of 14 brake-horse-power is used in this car. The motor is mounted upon a steel sub-frame, and its location in the center of the vehicle makes an equal distribution of weight. The body is mounted upon four full-elliptic springs 3 feet in length. The wheels are 40-inch diameter in front and 44 in the rear, and they are fitted with special flat-tread solid rubber tires of 1¾ inches diameter. Internal expanding brakes are fitted in the sprocket drums.



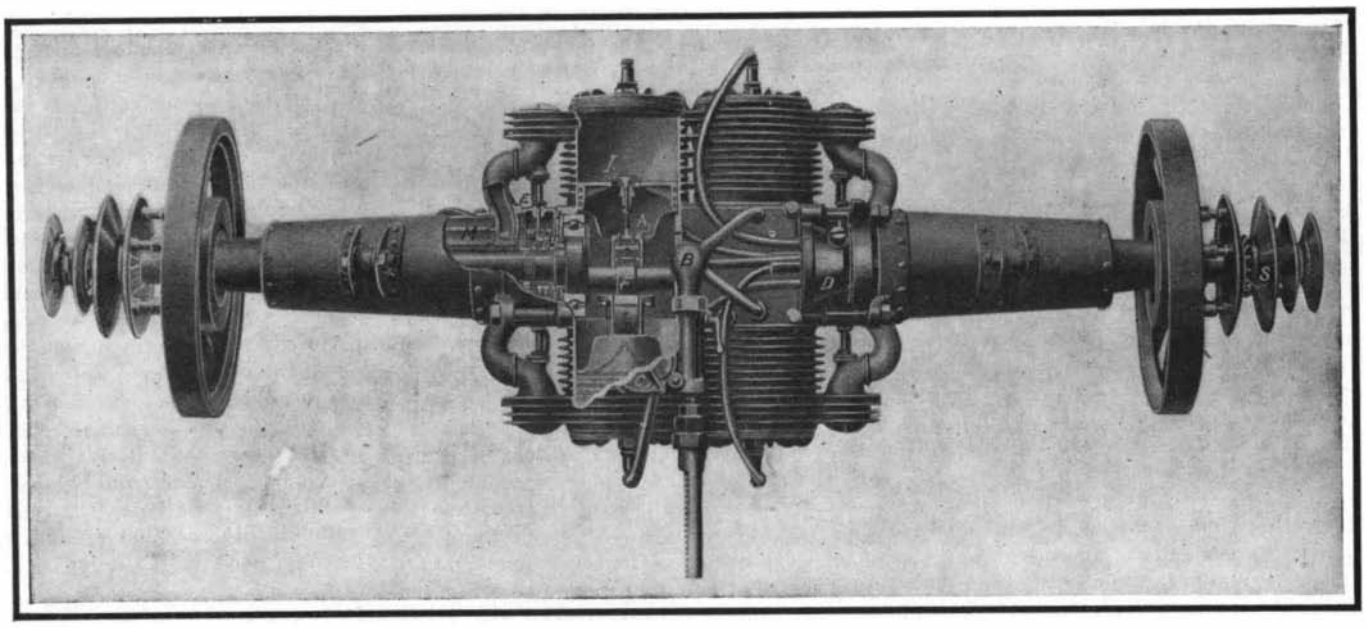
Power plant of the International motor buggy.

This is a typical power plant having an air-cooled double-opposed-cylinder motor with offset cylinders and all mechanically operated valves, direct-connected to a two-speed-and-reverse planetary transmission a single chain from which drives a countershaft carrying a differential. Two chains from the end of this countershaft drive the rear wheels. A novelty is the two fans ingeniously driven by a belt passing under and over the flywheel. The motor is thoroughly lubricated by a mechanical oiler having ten outlets.

The McIntyre machine has a motor of 4⅛ x 3¾ inches bore and stroke, rated at 12 to 14 horse-power. The wheels are fitted with 1¼-inch solid rubber tires and contracting ring brakes are used on the driving wheels. The front and rear wheels are 34 and 38 inches in diameter respectively. This concern has recently brought out a large four-passenger automobile with a four-cylinder vertical motor placed in front under a bonnet and with shaft drive through a two-speed planetary transmission to the rear axle. The motor used on this car has the same bore and stroke as the other and is rated at 28 to 32 horse-power. The use of solid tires on a large car of this kind necessarily limits the speed at which it can be regularly driven to not much more than 20 miles an hour; but for certain purposes the solid tire is preferable on account of its reliability and freedom from puncture.

Still another variation in the power plant of the medium-priced buggy-type machine is to be found in the Schacht runabout, in which a water-cooled double-opposed-cylinder motor is mounted transversely in the box at the rear of the body and is arranged to drive, by means of a composition alloy metal disk attached to its flywheel, a paper-rimmed wheel mounted upon a countershaft forward of the motor. This wheel contains a differential in its hub—a feature that is necessary in order to allow a difference in speed of the driving sprockets on the ends of the countershaft when the vehicle makes a turn. The drive to the rear wheels is by two side chains. The radiator used as a dashboard is a novel feature of this machine.

One of the simplest buggy-type automobiles yet devised is the "Buggyaut" of the pioneer automobile constructor, Mr. Charles E. Duryea. This machine is fitted with a two-cylinder, two-cycle, air-cooled motor of about 12 horse-power. The bore and stroke of the cylinders are 3¾ inches respectively. The motor is mounted in a horizontal triangular frame the base of which is formed by the extensions of the motor crankshaft through suitable casings. These tubular casings contain spiral pockets, *A*, and flanges upon the motor shaft extensions fit in the pockets. By rocking the tubular casing the shaft extensions are thus moved sideways and the two grooved pulleys at their ends are brought opposite the grooved rings on the wheels to obtain the low or high speeds. The frame containing the motor is then swung forward until the pulleys are brought into mesh with the rings sufficiently tightly to drive them by friction. The drive is similar to that of a locomotive upon rails, except that in this case the rails are round and grooved, thus making greater frictional contact and lessening the pressure required. The pulleys are made of steel, and the rings, which can be readily and cheaply renewed in a few minutes after they have worn out, are also of this material. Both the large rings and the larger of the two driving pulleys are made up of separate beveled circular pieces. A smaller ring with external grooves is used for the reverse. The bearings of the motor are large and are lubricated by grease cups. The cranks and pistons are lubricated by the feeding of oil with the gasoline, which system was introduced last summer by Mr. Duryea. The forward end of the triangular frame containing the motor is connected with the steering post, so that when the front wheels are turned in one direction or the other, the motor is moved slightly sideways and the friction upon the innermost driving-wheel ring is reduced, thus allowing the pulley to slip when the difference of speed occurs in turning a corner. The flywheel, *F*, is fitted with notches into which a lug on the starting spring, *S*, slips. A cord on the front end of this spring runs forward and over a pulley up through the floor. By pulling the handle on the end of the cord the motor can be turned over and started from the seat. A starting crank can also be used on one end of the motor shaft extension if desired. The two-cycle motor is by all odds the simplest and most reliable type, and when this is made air-cooled (as it is in this case by means of special copper heat-radiating flanges of great conductiv-



The twin opposed-cylinder engine and driving mechanism of the Holsman motor buggy.

The motor has novel features such as eccentric disks, *F*, on its shaft instead of cranks; inlet valves, *I*, in the pistons; and exhaust valves, *E*, operated by special grooved cams without gears. The pistons are connected together by a rigid frame and the eccentric disk works in a slot in same in a roller bearing, *A*. *C* is the carbureter and *B* the manifold connecting it to the crank case, into which the charge is drawn. The exhaust passes through the exhaust valves into mufflers, *M*, surrounding the extensions of the motor shaft. *D* is the distributor from which the wires run to the spark plugs. The power plant is hung upon two rollers. Note the expansible pulley with sprocket, *S*, for the low speed.

SOME TYPICAL MOTOR-BUGGY POWER PLANTS.

ity), and fitted with the simple lubricating arrangements that are used on such motors of the marine type, an engine of long life and simplicity and excellent wearing qualities is produced.

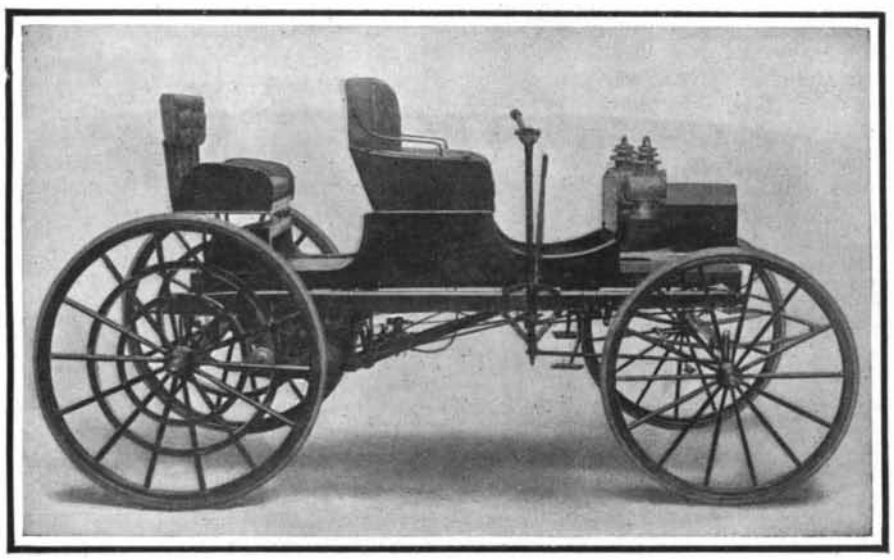
Another machine which resembles an ordinary automobile closely as far as the power plant is concerned is the "Simplo." This machine has a double-opposed-cylinder motor mounted in front under a bonnet. The motor is either of the air-cooled or water-cooled type. The longitudinal driving shaft, *S*, (see illustration) extends back from the motor to the middle of the frame and carries on its end a cone, *C*, of impregnated fiber, which is mounted to slide upon it. On a transverse countershaft there are slidably mounted two beveled disks, *FG* and *RG*. One of these disks, *RG*, is used for the reverse, while the other one, *FG*, gives the forward speeds. As the cone *C* is moved forward by means of a hand lever, the beveled disk *FG* is slid upon its shaft so that it is kept in close proximity to the cone. Contact is obtained by pushing the two together by means of a pedal, whereupon *C* drives *FG*, which in turn drives the live rear axle through its shaft by means of a single chain. As the driven disks are of metal and the driver *C* of paper, any wear caused by slipping does not wear uneven places upon the paper pulley, as generally happens when this is the driven member, which it usually is in most friction-disk transmissions. The principal point about the cone-and-beveled-disk transmission is that the entire friction surface of the two members is in good rolling contact and that there is no difference in speed between the two edges of the driven disk, with the consequent slippage that necessarily occurs with the usual type of flat friction-disk transmission.

To give some idea of the cost of maintaining and operating an automobile of the high-wheeled, buggy type, we append some figures obtained from a physician in a New England city, who has used one of them constantly for the past three years. The machine was in almost constant use about town and long trips were occasionally made with it into the country over roads that were none too good. The average cost per month for a period of 32 months was $38.31, which was distributed as follows:

Tires (8 at $8 each, requiring one hour to put on)	$2.00
Storage (machine kept in garage first year)	4.50
Oil	1.72
Gasoline	6.11
New parts (cables $15, chains $24.50, coil $42, sheaves $11.20, batteries $10, spark plugs $12, muffler, $6.75)	3.79
Overhauling (including painting once in 32 months)	9.00
Labor	9.19
Substitute vehicle during repairs	2.00
	$38.31

The machine referred to traveled an average of 20 miles a day and gave its owner satisfaction. The total cost of $0.06 a mile for the 20,000 miles it has been operated is about one-quarter the cost of running a pneumatic-tired automobile; and this could doubtless be considerably reduced in many instances.

In addition to the runabouts illustrated herewith, most manufacturers now make surreys and other forms of four-passenger rigs upon the same general lines. They have also entered the commercial vehicle field, and delivery wagons that can be quickly converted into passenger vehicles after they have been used for business are now on the market. The farmers of the middle West are rapidly coming to appreciate the advantages of this type of machine, and many of them are using it in place of horses. Such a convertible rig can be used to haul produce to market, and afterward to give the family a ride at the end of the day's work. It will traverse bad roads and is very serviceable.

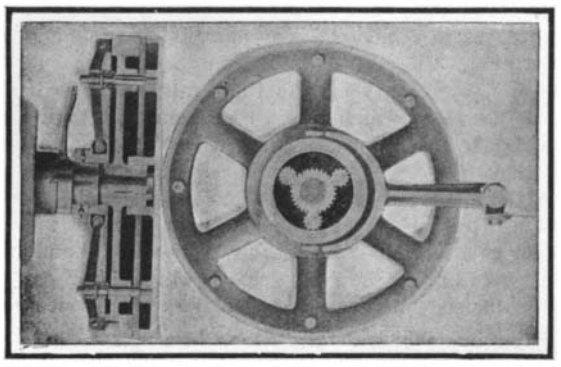


Duryea "Buggyaut" with extra foldable seat in the rear.

The simple friction drive direct from the pulleys on the ends of the motor crankshaft to the rings on the rear wheels is apparent in this photograph. The steering is done by a lever and the motor is throttled by twisting the steering handle.

The McIntyre motor buggy—a typical machine of this kind.

This machi e has a 10-11-horse-power, 3¾ x 3¾ double-opposed-cylinder motor, planetary transmission, and double side chain drive from a countershaft. A regular automobile steering wheel is used.



Disk transmission of the Schacht motor buggy.

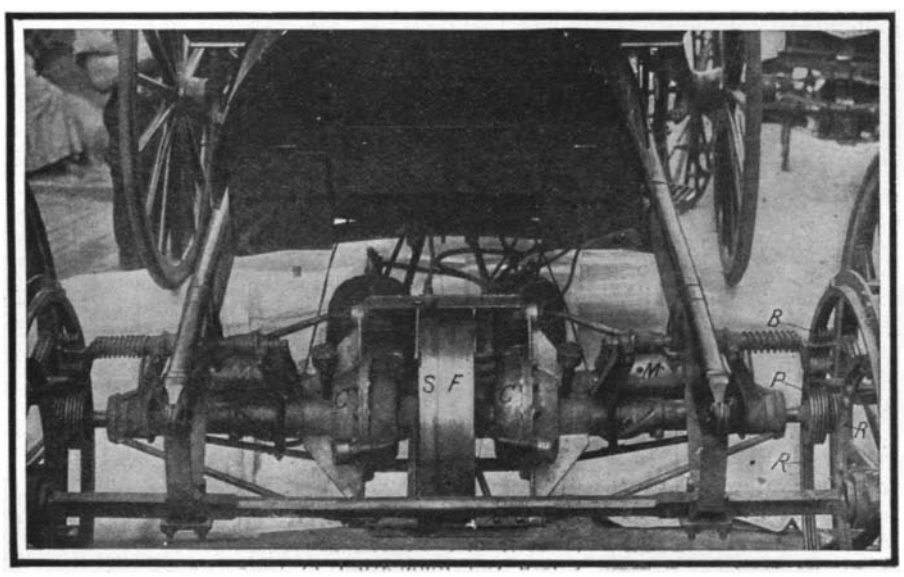
The large wheel with the differential gear in its hub is slid over the face of the disk attached to the flywheel in order to obtain the different speeds.

Analysis of Honey.

C. A. Browne has published the results of an exhaustive research into the composition of specimens of American honey, with special reference to the influences exerted by the nectars of various flowers and by local conditions. Browne also formulates general rules for the variations in the composition of honey, which will be very serviceable to chemists engaged in the inspection of foodstuffs, and suggests valuable tests and improvements of official methods of analysis. In addition a number of problems of the chemistry of honey are discussed, including the relations between honey and honey dew, gums, and other vegetable secretions, and the effect of artificial feeding of bees on the composition of the honey produced by them. The composition of honey dew, and floral nectars, and the methods by which they are transformed, "inverted" and preserved by the bees are described, and analyses are given of 100 specimens of honey, produced from 50 varieties of flowers in 32 States. The investigation includes both optical methods (direct polarization, polarization by inversion, estimation of levulose by Wiley's process) and chemical methods (determination of water, sugar, reducing sugar, ash, dextrine, free acid). The article also gives data concerning the adulteration of honey with cane sugar, invert sugar, and syrup made from starch, and methods of detecting such adulteration.

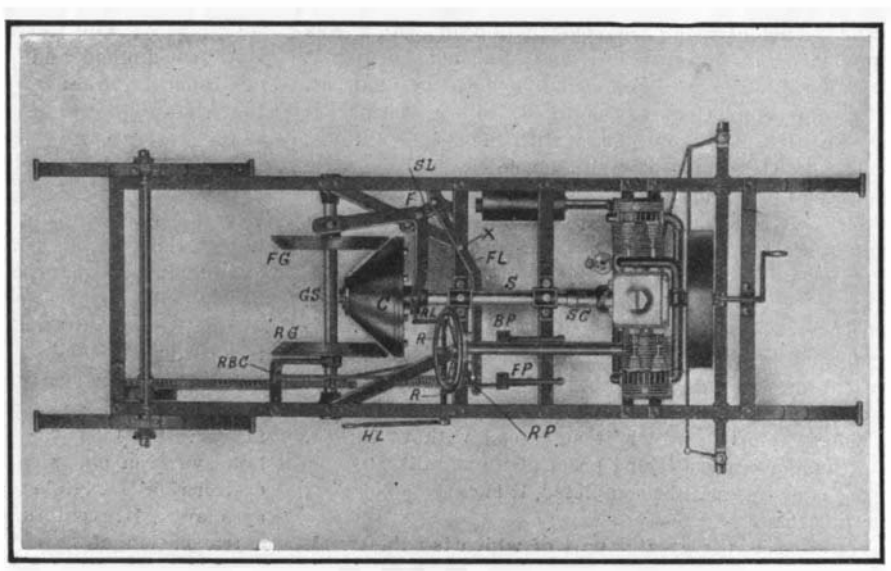
Death of Major E. L. G. Zalinski.

Major Edmund Louis Gray Zalinski, well known as the inventor of the dynamite gun which bears his name, and which was installed upon the "Vesuvius," died on March 11th in New York city. Major Zalinski was born in Kurnich, Prussian Poland, on December 13th, 1849, and came to this country when he was four years of age. During the civil war he served as an aide to Gen. Nelson A. Miles, and later entered the regular army. Between 1883 and 1889 Major Zalinski became widely known as an inventor of military devices and as an investigator of explosives. He was best known for his development of the pneumatic dynamite torpedo gun, which however never attained the widespread use that he hoped.



The power plant and driving mechanism of the Duryea "Buggyaut."

The two-cylinder air-cooled two-cycle motor has slidable extensions of its crankshaft carrying on their ends large and small grooved pulleys, *P*, which friction against the large grooved rings, *RR'*, for the forward and reverse motion. *B* is the brake shoe. The crank cases of the motors are shown at *CC*; *F* is the flywheel between the two; and *S* t e starting strap for starting the motor from the seat. The mufflers are shown at *MM*. *AA* indicate the spiral grooves in the crankshaft casing which, when the casing is rocked, cause the shaft extensions to move sideways and bring the small or large pulley opposite the ring for low or high speed.



Plan view of chassis of "Simplo" runabout.

S, Extension of motor crankshaft carrying conical driving disk, *C*. *FG*, Beveled disk meshing with *C* for forward drive. *RG*, Reverse drive disk. *GS*, Countershaft. *HL*, Hand lever for operating disks and cone *C*. *FP*, Pedal for bringing disks and cone in contact. *BP*, Brake pedal. The cone and beveled disks, which are used in place of the usual flat disks shown above, have several distinct advantages which will be found described in the text. This car is different from most of its kind in that a live rear axle is used and also in the placing of the engine in front under a bonnet.

SOME NEW MOTOR BUGGIES AND THEIR POWER PLANTS.