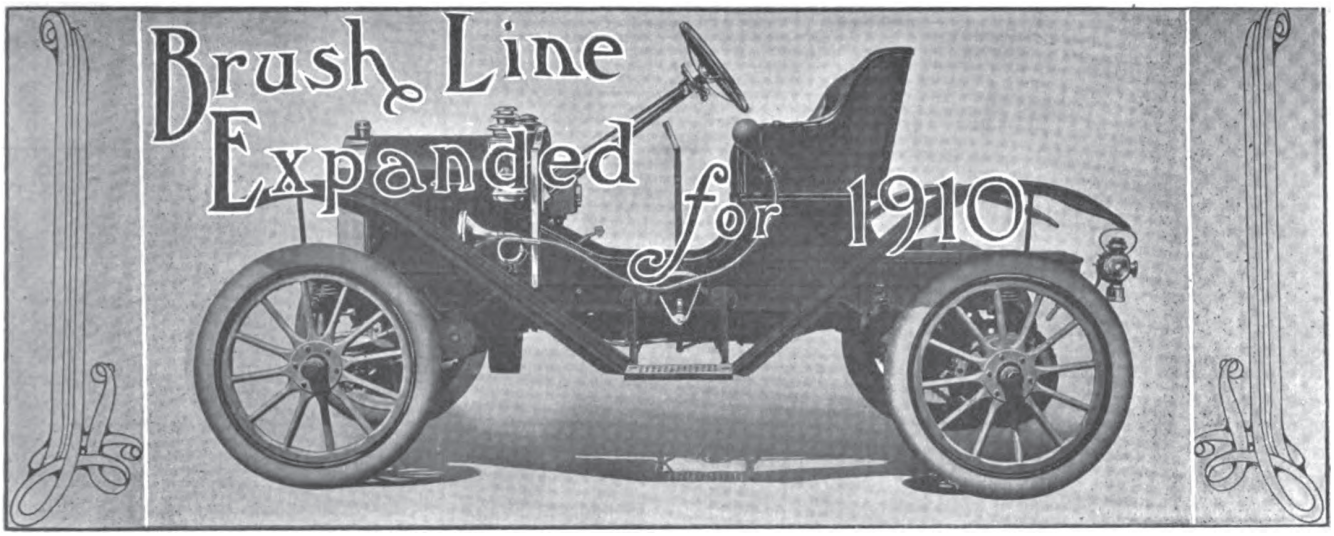

Fig. 1—Model D, regular $485 car, equipped with oil lamps, tools, tire kit, etc., and ready to run

SOMETHING of a sensation was experienced when the Brush first came into being, primarily because the price was low, relatively, and novelty was written all over the car. That merit also was a comparison seems to be borne out by the last year's performance, of which there are now so many cars in use that it is extremely difficult to stand on any prominent corner in Detroit for ten minutes during the day and not see one go by.

Under the circumstances it would seem as if it will be well worth the undertaking to investigate the car at some pains and ascertain just how it is made and try to tell why the maker deems it expedient to enlarge the line and turn out a vast number of the cars during 1910.

The prime idea of the Brush Runabout Company, of Detroit, Mich., is to make a standard chassis which will be available for use under a great variety of conditions and Fig. 2, representing a coupé, shows up one of the uses to which the chassis may be put to excellent advantage. Among the other selections, of which there will be eight all told, model D is the regular car, which represents a runabout type, as shown in Fig. 1, at the very modest price of $485. The remaining selections include a car with an ornamental tool box at the rear, another with a rumble seat and a third, in raceabout style, with an oval gasoline tank back of the seat of a capacity for a day's run.

The Brush from a Mechanical Point of View—The chassis frame is of wood, the reasons for which, according to the designer, is to afford lightness with strength and to attain a certain degree of flexibility and other qualities attributed to resilience. This is not a new idea, it being standard on such cars as Franklin, Panhard, etc.

The spring suspension is at variance with common practice, in that the chassis frame rests on helical springs placed just over the axles at the four points of suspension, and in order to induce a slow rate of vertical bounce following road inequalities attended by speed of the car, the distance rods are terminated at the chassis frame for the front and hind axle at both sides in friction disk members, so contrived that the friction set-up, due to vertical motion of the axles, will be enough to assure that the travel of the body in the vertical direction will be gradually snubbed and the rate of change of motion will be that described as agreeable riding qualities.

Some earlier attempts to use helical springs for chassis suspensions failed to come up to the expectations of designers, primarily because the snubbing action of the friction members was not taken advantage of and the axles were very heavy indeed, considering the things to be accomplished. The Brush plan does not end with placing friction members to limit vertical bounce, for the axles are made of wood in order that they will not be heavy, although it is recognized that they must be strong.

At first thought it might be considered that axles of wood in an automobile is an innovation not to be taken seriously. Let us have another look. These axles weigh but a few pounds; regular live rear axles weigh nearly 200 pounds. The difference is the story of energy of impact and the influences of acceleration. Were the axles heavy, as they would have to be were they made of metal in the usual way, there is small chance that the friction members on the ends of the distance rods would be capable of snubbing the motion of the rapidly bouncing axle at high rates of road speed and with rough going.

By making the axles so that they weigh but little, the featherweight impact component is not enough to overcome the "damping" ability of the shock absorbers, and the body rides on an even platform even when the speed of the car is quite high and when road inequalities are pronounced. There is one point in favor of helical springs aside from the fact that they are practically unbreakable, and that is, they are capable of recovering at a more

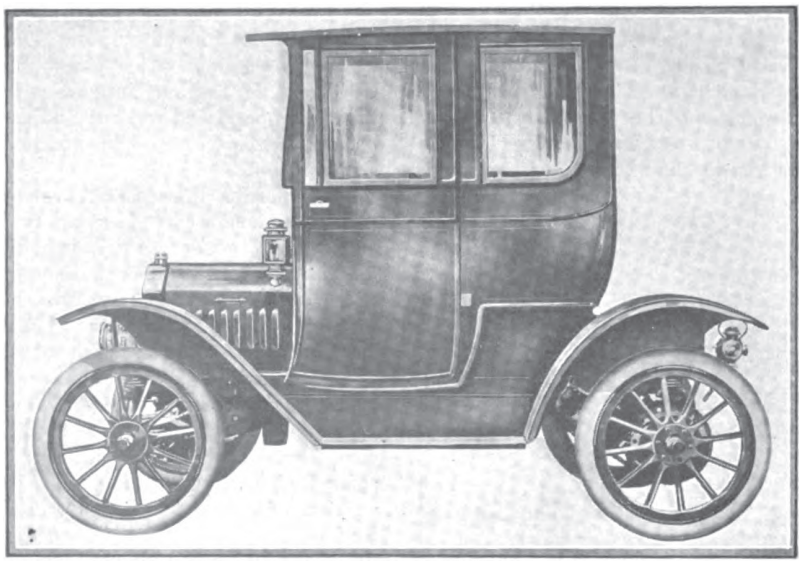

Fig. 2—Brush chassis, equipped with coupé body

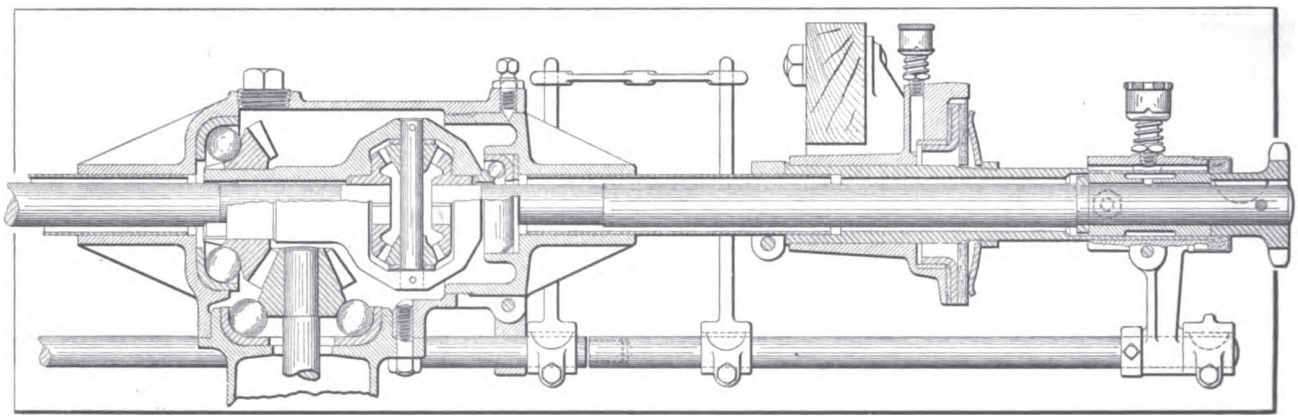

Fig. 3—Depicting jackshaft in section with differential and large ball bearings for the bevel drive

than usual rate when a wheel drops into a rut, and the general performance is very satisfactory, simply because the weight of axle is not enough to disturb the otherwise good relation. As to the strength of wooden axles, it is not necessary to go into detail; they were used in every wagon in the land before steel came into vogue, and the history of wagons does not disclose that they failed in any particular. Four thousand Brush cars add to this favorable historical fact, and this phase of the dis-

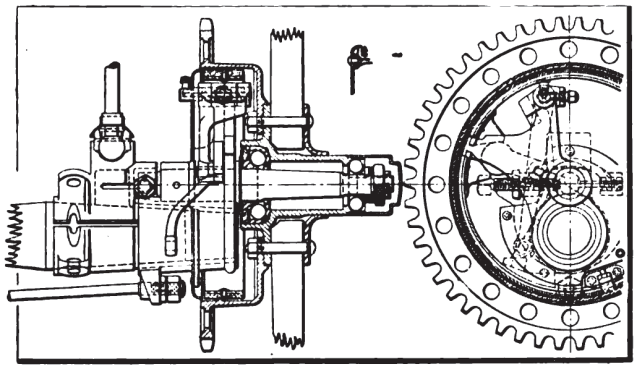

Fig. 4—Rear wheel, sprockets, brakedrum, showing ball bearings, and system of protection against silt of the road

cussion may therefore be dismissed as being too trivial to warrant the taking of time and space.

Belongs to the Side Chain Drive Genera—Referring to Fig. 3, of the jackshaft, which is placed across the chassis frame in front of the hind axle a sufficient distance to allow of the required length of sprocket chains, of which two are used, placed as is the custom in cars in general. The differential gearset is shown in section and the cup and cone ball bearing to one side of the housing take the load at this point. The bevel drive also shows on the end of the differential sleeve, engaging

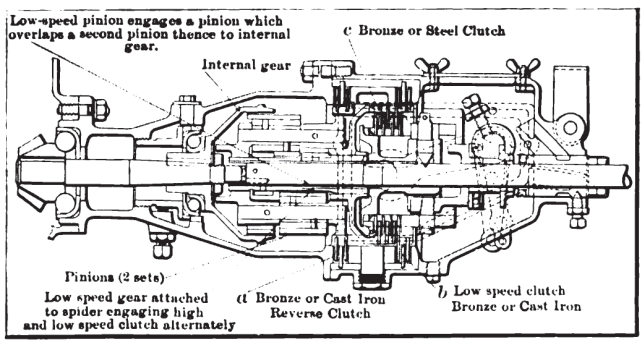

Fig. 5—Planetary gear set, showing multiple disc clutches, system of gears, and screw system of engaging the high speed

the driving pinion on the end of the propeller shaft, leading from the motor through the transmission gearset.

The large ball bearings used to back up the bevel drive are excellent indications of the plan of the designer, and, as will be well appreciated, the larger the balls are the longer they will last under thrust and high-speed conditions, which is the reason for the large balls used. The material of which the bevel gears are made is that which will best stand cementation and the finished gears are capable of serving for ball races of competence as well as for the regular work of transmitting power.

The remaining features of the jackshaft will require no more than a glance to disclose the character of the design and workmanship, and grease cups are placed at all points for the customary purpose and with the further idea that as grease oozes out silt of the road will not be creeping in.

Fig. 4 is a section of the rear axle, showing how the sprockets are fastened to the rear wheels by engagement at the bolting of the hub flanges, using the regular hub bolts for holding, and the brake drums are integral with the sprocket wheels. The brake shoes are of adequate stiffness, remembering that they are of the internal expanding type and have to be stiff to properly work, while the facings are wide, of material which affords a high coefficient of friction, and the means of applying pressure show competence. The brakes are inclosed and the dust cover is so contrived that it serves its purpose admirably.

The distance rods fasten to the rear axle just under the spring perches as shown, and a ball and socket (universal) joint, using large diameter ball for the purpose, takes the work, eliminates noise and may be adjusted at will. The wheels are fitted with 28 x 3 1-2-inch pneumatics and the cup and cone ball bearings are even large for the purpose. One other point before departing from the rear axle design; the means for adjusting the wheels to the bearings includes a large hub nut, castellated so that it can be locked when the adjustment is properly made, and closures are placed to keep grease in the cavity as well as to keep silt out.

Transmission Possesses Novel Features—The transmission is of the planetary type, giving two speeds and reverse. Like all planetary gears, when it is desired to go at high speed a clutch is interposed to lock the gears so that the whole nest rotates and the drive is that known as "direct on high"; to go into low, or reverse, the usual custom is to hold the drum by means of friction bands, which may be tightened at will. In the Brush multiple disk clutching members are used in the three cases, bands are eliminated and the ability of the low and reverse clutches is equal to the requirements as measured in this way. The clutch for the high speed (direct on high) differs again from clutches in general in that the means of engaging is novel and is claimed to possess certain specific advantages. The section Fig. 5 shows the general arrangement, in which will be found the high-speed clutch, consisting of disks resting between vise-like jaws, one of which is formed out of the spider and

the other is in concentric relation, sufficiently spaced in the axle plane to afford room for the disks plus clearance when the clutch is not engaged.

When it is desired to engage the high-speed clutch, movement of the lever results in the closing of the vise on the disks, as follows: Through the compound action of a screw, which is thrown into engagement by the lever system, the original effort of the operator is added to by the torque of the screw, transposing the torque of the motor. All the operator has to do is to make the initial effort and the pressure resulting is enough to bring the screw into action, when the torque of the motor will wind up the screw and tighten the clutch, all without the use of a heavy spring and at the expense of a minimum effort on the part of the operator, while, at the same time, the engagement is not only gradual, but positive.

The screw effect is brought about by so shaping the metal sleeve so that rollers, which protrude into spiral slots in the sleeve, will screw the sleeve into engagement once the initial motion is imparted by the operator. In disengaging the clutch the reverse action follows and the disengagement is positive and quick.

The planetary, as shown, belongs to the internal gear type, is therefore free from noise when well made, and the low-speed pinion on the shaft, when going into reverse, transmits its motion through overlapping, intermediates, of which there are two pairs, thus making the mechanical balance perfect and assuring adequacy of mechanical ability without having to use large members attended by noise, inertia effects, etc.

The low-speed gear which is attached to a spider is free to engage either the high or low-speed clutch at will, thus perfecting the device for the purpose. The whole system is properly inclosed, may be packed with grease, is so simple to operate that skill is not required and to make a wrong move is quite out of the question, even in the absence of knowledge.

Novelty Resides in the Motor—The single-cylinder motor is rated at 10 horsepower and is of the vertical type placed in front, as in foreign practice. The power of the motor is greater by 3 horsepower than that of the last year's product, not so much due to any very great demand, but, as the designer put it, so that drivers will feel the excess and worry will then be out of a job. The cylinder is of the L type, as depicted in Fig. 6, and among the advantages symmetry has a claim. The head is screwed in against a bevel seat, is rendered tight by the pressure of the head cover against the seat and is readily removed at will if it becomes necessary to clean out the combustion chamber space, as when carbon forms. The valves are large, press against bevel seats, are properly water-jacketed, and, by means of adjustments at the terminals of the tappets, timing may be accomplished to a nicety at any time.

The crankshaft, as shown in Fig. 8, is of 40 points carbon open-hearth steel, stout of section and balanced. Even when

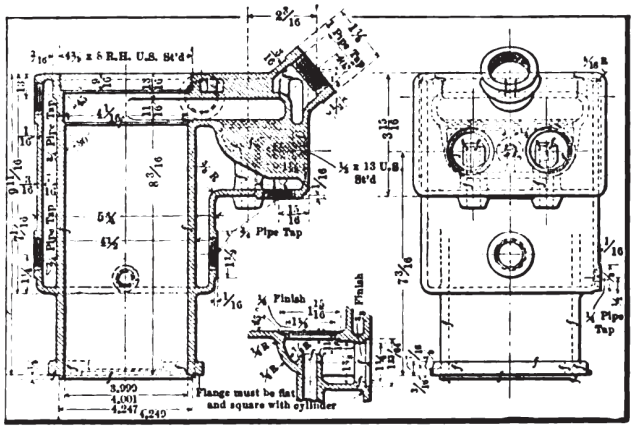

Fig. 6—Cylinder of gray iron, with screwed in head, bevel seat to make it tight, and valves at one side

balanced to a nicety a crankshaft in a single-cylinder motor cannot be free from unbalanced secondary moments, and it is in this particular that the 1910 Brush offers a new innovation. Fig. 7 shows a balanced gear which meshes with a gear of the same diameter on the crankshaft. The balance weight in the gear Fig. 7, in a plane parallel to the balance weight on the

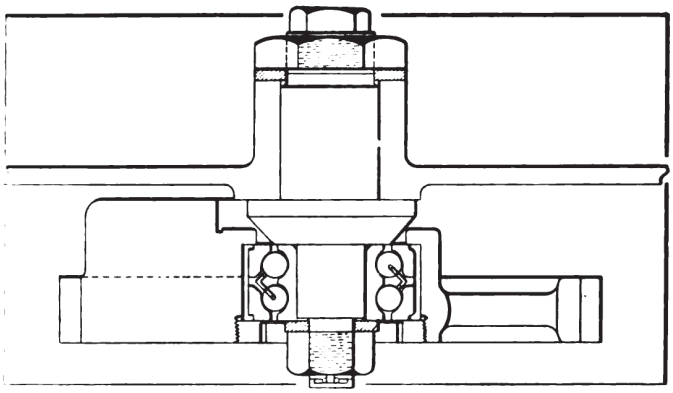

Fig. 7—Auxiliary balance gear showing New Departure ball bearing and eccentric spindle with adjusting nut outside

crankshaft, and since the crankshaft balance takes care of all unequal rotary moments plus one-half of the unbalanced secondary moments, it remains for the auxiliary balance (balanced gear) to cope with the remaining unbalanced secondary moments.

The secondary balance rotates on an axis above the axis of the crankshaft a distance sufficient to compensate for angularity of the connecting rod, and while it is not claimed that this sec-

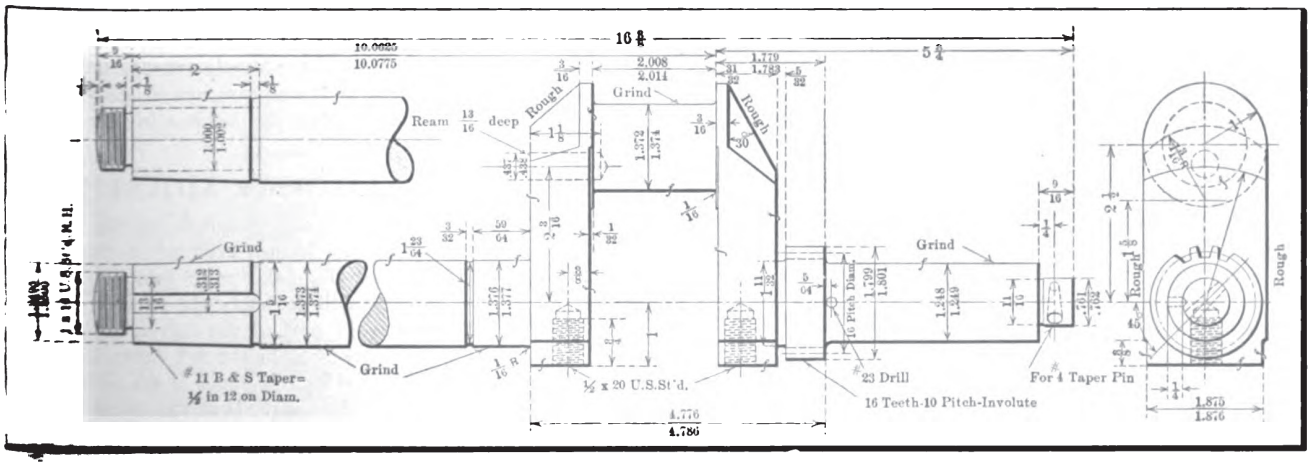

Fig. 8—Crankshaft of 40-point carbon open hearth steel, with liberal bearings surfaces, stout arms and means of direct and auxiliary balancing by thorough use of an auxiliary balance gear

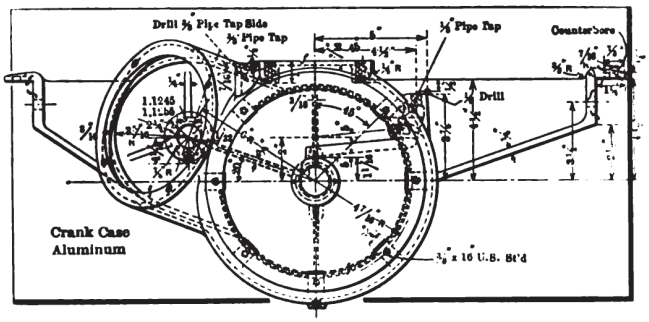

Fig. 9—Crankcase showing opening for balance gear, arms for supporting, and general design

ondary balance is capable of perfection in the sense that the ills of all secondary movements will be dispelled, even so it is the fair claim of the makers that a four-cylinder smoothness accompanies single-cylinder simplicity, and the performance of the motor seems to be the proof of the pudding.

The bore of the cylinder being 4 1-2 inches and accompanied by a longer stroke than formerly (5 inches for 1910), the power is vastly increased over what might have been the normal expectation, since the balance is sufficiently corrected to allow of running the motor at the higher speeds for which four-cylinder motors are adapted, and more power results.

This auxiliary balance is a new idea in American motor practice and in view of the revival of the single-cylinder motor, due to its simplicity and economy, it is reasonable to expect that the auxiliary balancing idea will have a large influence on the future of this situation. It was expected that the balance gear would introduce noise to some extent, which was the theoretical objection to its use, but the quality of work done in the Brush shop seems to be proof against this tendency.

The introduction of the balance gear makes the aluminum crankcase of the motor look as depicted in Fig. 9, looking at it from the end opposite the flywheel, and the opening to the left is that through which the balance gear is passed in assembling or examined thereafter at will.

Fig. 10 represents the steering gear, in which the reduction ratio is 6:1 and the performance is that of a well-thought-out device. The ball on the end of the steering lever is 1 inch in diameter and means are provided to take up lost motion if time makes inroads on the hardened cups which encircle the ball. The gear is rigidly supported to abort possible lost motion from this cause and the sleeves bearing leading to the gearset is long.

An inspection of the material and the way the cars and parts

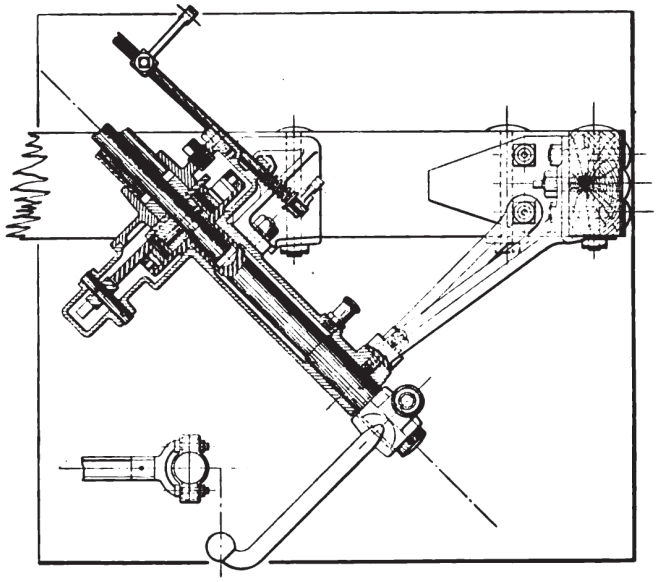

Fig. 10—Steering gear, having a 6 : 1 ratio, long bearings, and strong support to frame

are worked up in the shop leads to the conclusion that a well-thought-out shop system is at the bottom of much of it, and it must be remembered that, while the Brush car is still young, it is built under the "watchful eye" of the responsible head of the Briscoe Manufacturing Company in a well-equipped plant which dates back into automobile history. This plant is primarily devoted to the manufacture of radiators, and is fitted out to do this and other accessory work on a large scale. The machine shop, for illustration, is modern, holds in its makeup a fine assortment of special machine tools of the most modern description, and the force of men available is large and skilled in automobile work. It is for this reason that the Brush car has been brought to a high plane and a large number put on the road, despite the fact that the new plant in which the cars will ultimately be turned out is not ready for occupancy. The new plant will be ready for this year's work.

ACCOMPLISHMENT OF ENGINEERS

The remarkable demands made on automobile engineers and the astonishing way in which these demands have been answered have produced the high-priced car of to-day. It is a wonderful creation and there is not a standard car made that is not worth more than is charged for it. At the same time to stand at any populous thoroughfare and see the hundreds of $2,000 to $5,000 vehicles rushing past carrying one or two persons makes one feel that we are living in an age of Babylonian luxuriousness.

Frank Briscoe

In recent times the medium-priced cars have been developed and sprung into favor, taking advantage of the skill and experience in the more luxurious class. Considered as a luxury, the high-priced car is magnificent, but for the great useful demand for transportation off of rails the utility type of car is offered.

Conspicuous efforts to put out very low-priced cars failed because the makers built them crudely, considering price only of importance, whereas the real endeavor must include the lesson learned by engineers and manufacturers, whose goal was results rather than price. We have, furthermore, learned new lessons, finding that just as much accuracy and strength must be put into the smallest car built as in the more pretentious. In point of being "fool-proof" the low-priced car must excel its big prototype for obvious reasons.

The object in the Brush runabout enterprise, aside from the primary one of making money, is twofold: First, to accomplish the broadest part of the demand for simple transportation, and, second, to make purchasers of larger cars appreciate the utility of the other class and thus stimulate the business in general.

PROPER SHOCK ABSORBER ADJUSTMENT

It sometimes happens that the adjustment is not the same on both sides of a car. This may happen even when the pointers indicate the same number on the dial, due to inaccuracy in dial setting. It is a matter of skill to apply the remedy, since it involves a readjustment on the part of the driver, and he must "feel" of the car, so to speak, and in the act determine if the "drag" is the same on both sides. If there is no dial, the adjusting process will be quite the same. It is too much to expect of shock absorbers that they will serve any good end unless they are capable of offering a well-regulated drag and of responding in step with the motions of the body.