A NOVEL 4-CYLINDER TOURING CAR.

The new Northern touring car is of the 4-cylinder type. The cylinders and water jackets are all in one galvanized casting, the cylinders being properly spaced to allow of a thorough circulation of water. The bore and stroke of the motor are 4½ x 5. It is rated at 30 horse-power, and, at 900 R. P. M., will drive the car

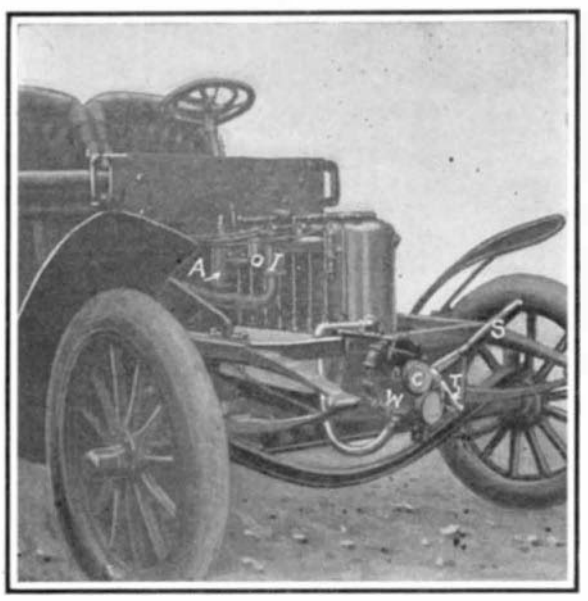


Fig. 1.—FRONT END OF NORTHERN TOURING CAR.

The radiator is removed so as to show parts. *A*. Air compressor. *C*. Contact box. *I*. Inlet pipe. *O*. Carbureter. *S*. Starting lever. *T*. Water pipe. *W*. Inclosed half-speed gears forming water pump.

at a speed rate of 30 miles an hour. The crankshaft is offset slightly from the center line of the cylinders in order to get a better leverage on the power stroke, and the same practice is followed with the cam shaft, which is placed at one side of the valve stems instead of directly under them. The engine has liberal hand holes in the base for adjusting the crankshaft bearings. The valves are all in the heads, and are operated mechanically by tappets and push rods. The eight rods can be seen on the left side of motor in the cut. The carbureter, a small float-feed affair, is fastened to the inlet pipe, *I*, at *O*. No special water pump is used, the inclosed 2-to-1 gears at the front end of the motor being made to serve this purpose. The water pipe is shown running from the base of the forward cylinder to the incased gears. The pipe, *W*, on the other side conveys the water to the radiator, and thence to the water jacket. The radiator, which is not shown in this view, is placed as usual in front. The commutator is located at *C* on the same shaft with the 2-to-1 gear. It is readily accessible, as can be seen. While these are novel features, they are by no means the only original ones about the car, for the control, clutch, and transmission are all along novel lines. An air compressor (*A*, Fig. 1) is driven by a crank on the camshaft. A valve on top makes it possible to obtain any desired pressure up to a certain point. A pipe runs from the compressor to the forward end of the crankshaft, which is made hollow throughout. The flywheel contains an annular chamber, in which are two steel disks separated by two thin disks of fiber. The rearmost steel disk is connected to the propeller shaft through a universal joint. Both disks, as well as the joint, are thoroughly inclosed and protected. The chamber in the flywheel is air-tight, and by admitting the air pressure between the disks it locks them to the

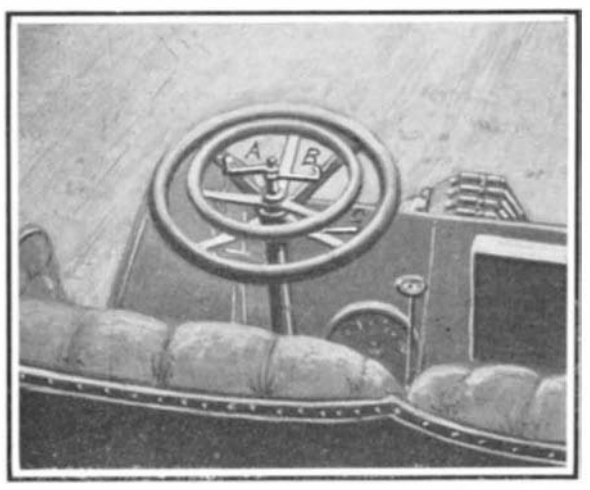


Fig. 2.—CONTROL APPARATUS OF NORTHERN CAR.

The gears are shifted by the smaller wheel within the steering wheel. *A*. Spark handle. *B*. Clutch handle. *C*. Throttle and air brake handle.

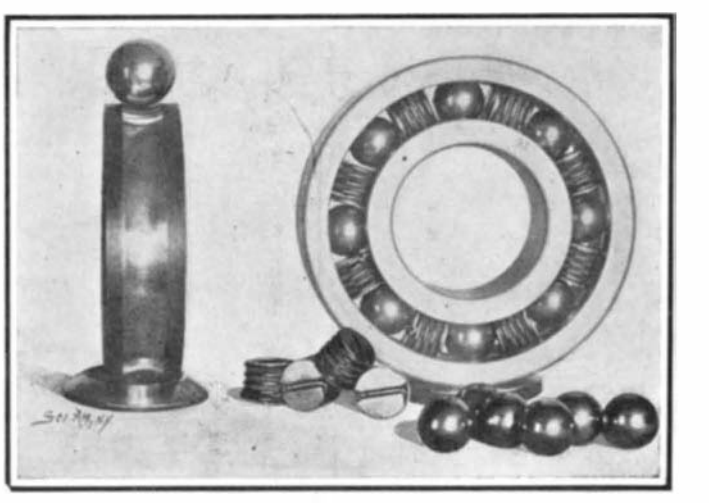
flywheel, which then drives the propeller shaft. The disks are 11 inches in diameter, and with 75 pounds air pressure, three tons driving pressure is obtained in the clutch. By opening the air valve a little at a time, the clutch may be made to take hold very easily and without any jerks. The transmission is located just in front of the rear axle, and the only connection, in addition to the propeller shaft, which it has with the front of the vehicle is a single rod for shifting the gears. This rod is connected so as to be operated by a smaller wheel within the steering wheel. The reverse is obtained by depressing a pedal on the steering column. It is impossible to throw the reverse into action unless the gears are in neutral position. The great strength of the rear axle and the wide band-brakes employed on the hub of the rear wheels can both be seen in Fig. 3, which also shows the long muffler tubes extending nearly the whole length of the body underneath the same. The band brakes are operated by compressed air, and are very powerful. The bands are 3½ inches wide. Inside the brake drums are expanding ring brakes 3 inches wide. These are operated by a pedal, and are to be used in case of emergency.

Still another novel feature of the new Northern touring car is the lever starting apparatus shown in Fig. 1. This consists of a long lever having a pawl engaging with a ratchet-toothed wheel on the motor shaft, and thus making it possible to turn the motor over easily by a series of pulls straight from the shoulder, instead of having to swing a large crank. Grease cups on the bolts of the springs keep these properly lubricated at all times. This is one of the minor details of the car, but one which shows how much thought and ingenuity have gone into its construction.

The control of the machine is almost entirely by the three small levers and the two wheels shown in Fig. 2. The smaller wheel, as previously stated, shifts the gears and gives the first, second, and third speeds forward. A direct drive is obtained on the high speed. By turning this wheel back to the neutral position, and depressing the pedal at the base of the steering column, the reverse is obtained. The small lever, *B*, operates the clutch, while the lever, *A*, is for advancing or retarding the spark. Below the steering wheel is the throttle lever, *C*. Moving this forward opens the throttle, while moving it backward closes the throttle and applies the air brakes. Thus it can be seen that the car is controlled almost entirely by the back-and-forth movement of this one lever. The location of the steering column on the left side of the car is an advantage in passing through traffic, as it enables the driver to see what is in front of him before turning out for a vehicle. Furthermore, when approaching a curb, the empty seat is always next to the latter, and it is not necessary for the car to be turned around. The weight of this car is approximately 2,300 pounds, and the speed possible to obtain with it is in the neighborhood of 50 miles an hour. The car has a wheel base and a body capable of accommodating five people. It is shod with 32 x 4-inch tires. Besides this new car, which is constructed under the patents of Charles B. King, the Northern Manufacturing Company still builds its double-opposed-cylinder touring car and its single-cylinder runabout. A feature of the former car is the use of interchangeable bodies, which makes possible a closed Limousine for winter, or an open side-entrance tonneau for summer use.

A SILENT NON-ADJUSTABLE BALL BEARING.

Ball bearings were originally used on some of the first automobiles constructed in this country; but owing to the constant trouble which they gave, most of the makers discarded them. During the last two years a new type of ball bearing has been developed in Germany, and has found its way into use on many of the leading foreign cars. Owing to the fine quality of steel used in its manufacture, and to the great care with which the balls are examined and tested, this bearing has shown itself to be very reliable under almost all conditions. Its friction is so small that the loss amounts to only 1-8 or 1-6 of one per cent of the total load carried, instead of from 3 to 5 per cent; while the starting friction is no greater than the friction when running. The new bearing consists of two annular ball races, each of which is in one piece. By placing the outer ring in a position eccentric to the inner one, the balls can be slipped into place with the coiled springs between them. The latter keep the balls separated, so that there is no clicking sound as they drop over the top of the bearings, such as is the case with the ordinary bearing. A wool pad placed inside the spring absorbs sufficient oil to keep the balls lubricated for long periods. The balls and races are made from a special high-grade steel. Both are very hard and tough, and have a high polish. Numerous tests are constantly made of sample sets of bearings, in order to be certain that the quality is maintained and in order to improve, if possible, this quality. As the result of such tests the manufacturers have discovered a new steel alloy that allows the load on the bearings to be doubled. But one ring of balls is used in any bearing, the result being that the space required is much smaller than is usual. The fewer balls used also tend toward simplification. These bearings are used almost universally in the transmissions and wheels of high-grade cars. The Daimler Company has become a convert to their use on the engine crankshaft, and both the Mercedes and Hotchkiss machines use them in this important part. Their high efficiency and the little attention which they require make them ideal for automobile service.



THE HESS-BRIGHT NON-ADJUSTABLE SILENT BALL BEARING USED ON MANY HIGH-GRADE TOURING CARS.

The Current Supplement.

Jacques Boyer opens the current Supplement, No. 1567, with a most thorough article on the methods

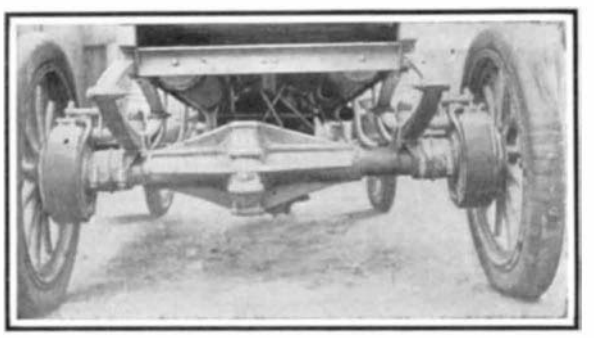


Fig. 3.—NORTHERN REAR AXLE.

The wide band brakes are applied by compressed air. Expanding emergency brakes are connected with a pedal. The long muffler tubes can be seen on each side beneath the body.

employed in France for fattening fowls. Wonderfully sharp and clear photographs accompany his text. John C. Sparks gives some wholesome advice on the subject of boiler compounds. Of the interesting features of modern constructive practice which call for appraisement, either from their extreme novelty or successful application, none holds so high a place as the remarkable adaptability of armored concrete to the many and varied engineering requirements of the times. For this reason Lieut. Henry J. Jones's thorough discussion of the subject will doubtless be read with interest. Sir Oliver Lodge, in a most striking paper entitled "A Pertinacious Current; or, the Storage of High-Tension Electricity by Means of Valves," shows how it is possible to dissipate fog or smoke or to deposit metallic fumes. A tunnel was recently bored through the Santa Cruz Mountains which is of engineering interest, inasmuch as it is approached at one end through a concrete retaining wall or dam that has stood for over eleven years without the least sign of cracks or any failure whatever. Mr. Herbert I. Bennett describes this wall and its method of construction. Prof. A. E. Outerbridge reviews recent progress in metallurgy. The Generation of Ozone by Means of Ultra-violet Light is briefly described.

Official Meteorological Summary, New York, N. Y., December, 1905.

Atmospheric pressure: Mean, 30.09; highest, 30.86; lowest, 29.46. Temperature: Highest, 57; date, 3d; lowest, 19; date, 1st; mean of warmest day, 48; date, 3d and 29th; coldest day, 24; date, 15th; mean of maximum for the month, 43.6; mean of minimum, 31.8; absolute mean, 37.7; normal, 34; average daily excess compared with mean of 35 years, + 3.7. Warmest mean temperature for December, 42, in 1891. Coldest mean, 25, in 1876. Absolute maximum and minimum for this month for 35 years, 68, and — 6. Average daily excess since January 1, + 0.2. Precipitation: 3.67; greatest in 24 hours, 1.38; date, 20th and 21st; average for this month for 35 years, 3.40; excess, + 0.27; accumulated deficiency since January 1, — 0.17. Greatest precipitation, 6.66, in 1884; least, 0.95, in 1877. Snow, 0.7. Wind: Prevailing direction, west; total movement, 10.774 miles; average hourly velocity, 14.5 miles; maximum velocity, 64 miles per hour. Weather: Clear days, 8; partly cloudy, 12; cloudy, 11.