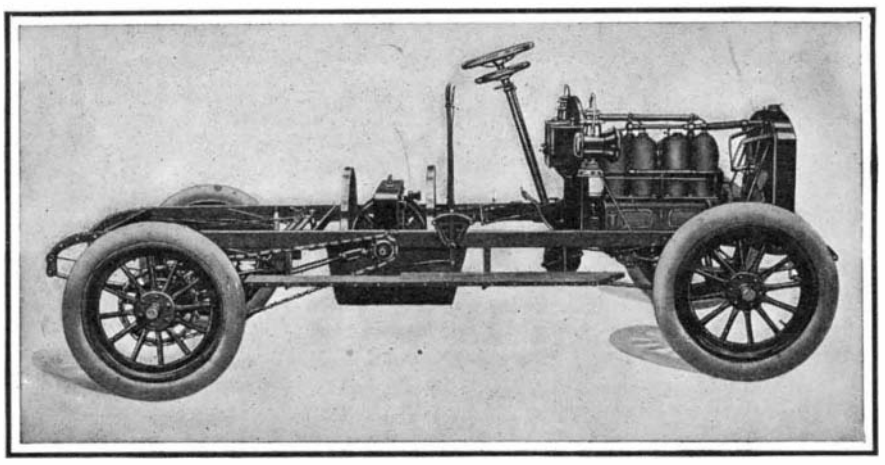
FRICTION-DRIVE CARS

A NEW DOUBLE-DISK TYPE OF FRICTION-DRIVE AUTOMOBILE.

In the view of the chassis shown herewith, upon close examination the reader will note the tops of two transverse disks that project upward at about the middle of the frame. These disks are on an extension of the engine crankshaft, and they not only act as flywheels, but also serve to transmit the power to two short countershafts, whence it is carried by chains to the rear wheels of the car. For this purpose each countershaft has slidably mounted upon it a smaller disk wheel. The short countershafts are pivoted so that, by the movement of a pedal, they can be brought in contact with, or separated from, the main driving disks. Normally, one of the small wheels comes in contact with one disk and the other with the second disk when the pedal is pushed forward. This rotates both small wheels in the same direction. The reverse is obtained by swinging the countershafts so that their respective wheels contact with the opposite disks. The wheels can be moved in unison toward or away from the center of the disks to obtain the variation in speed. This is accomplished by the second wheel seen below the steering wheel. No differential is required, as the differential movement is allowed for by the slip of the smaller steel wheels on the leather-faced disks. This machine is a variation of the usual friction drive arrangement, such as is described below. In doing away with the differential, the designer has hit upon a rather more complicated arrangement. This, however, has the advantage that there are no differential gears to wear or strip, while since the drive to each rear wheel is entirely separate, in case of accident to one side of the transmission the car can still be propelled by the other.



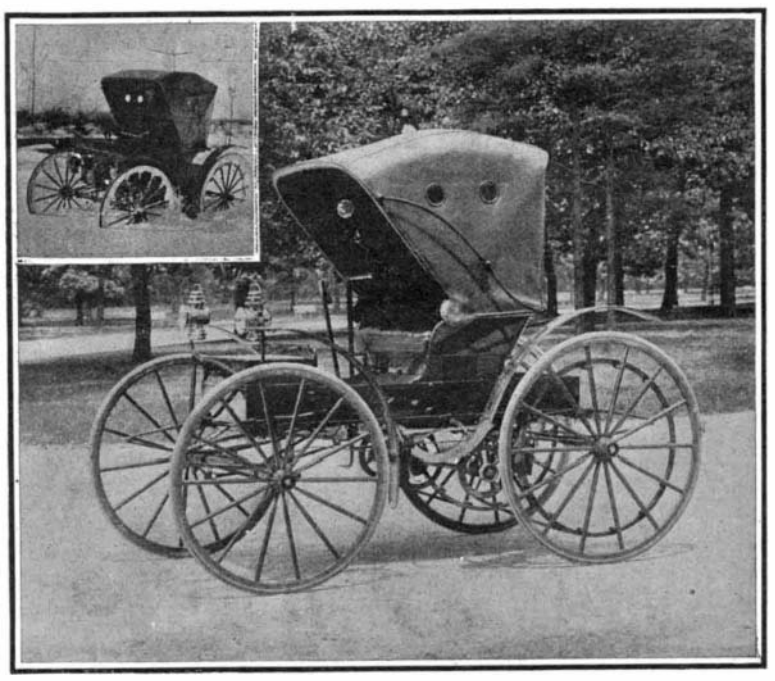
CHASSIS OF SIMPLICITY FRICTION-DRIVE AUTOMOBILE.

In this type of friction-drive car two large disks on the prolonged crankshaft drive two smaller wheels on two short transverse shafts that carry the driving sprockets.

THE HOLSMAN ROPE-DRIVE AUTOMOBILE.

By the use of wire-rope cables for transmitting the power from the countershaft to its large rear wheels, the Holsman automobile is put in the class of friction-driven machines. This buggy, with its large wood wheels and solid rubber tires, is the nearest approach to the horseless carriage type of automobile that has thus far been produced. Save for the fact that it is steered by the usual steering knuckles, instead of by swinging the entire front axle on a fifth wheel, the Holsman machine is in nearly every respect like a horse-drawn buggy. It is fitted with a double-opposed-cylinder engine of 4 inches bore and stroke, placed fore and aft beneath the body, and driving through two Morse silent chains a countershaft placed beneath. Either one of the two sprockets on the engine shaft can be engaged by means of a sliding feather, which is shifted by a small lever on the front part of the seat. Ordinarily, the starting and running can all be done on the high speed. This is accomplished by pulling back the long lever at the right of the driver, which throws forward the countershaft and tightens the ropes, thereby transmitting the power to the rear wheels. A differential is not necessary, as the ropes can slip without damage. These ropes are in reality special wire and rope cables, made of the strongest Manila rope and steel wire. Besides giving a silent drive, their life is considerable. The reverse is obtained by a forward movement of the hand lever, which causes two small grooved wheels on each end of the countershaft to come in contact with the rubber tires on the rear wheels, thus driving the vehicle backward at a slow speed. On account of its large wheels and solid rubber tires, the vehicle runs and rides very easily. It is steered by a lever, and can be run at as high a speed as 30 miles an hour. The motor and the body are mounted on two long side springs, which absorb all the shocks from the road.

That this machine, as well as the larger four-passenger one built by the same firm, is quite practical upon ordinary rough country roads, is proven by the fact that one machine of each type won first place in their respective classes in a 105-mile reliability run from Chicago to Aurora and return, held last July. Out of eighty-four cars which completed the run, the smaller Holsman machine and two Maxwell runabouts made perfect scores; while the larger Holsman car (which, however, was fitted with the same engine) was penalized only 14 points, as against 151 of its nearest competitor. The small photograph in the corner of the larger cut shows the advantage of large wheels upon snow-covered roads. A machine of this type can traverse deep snow without any very great difficulty. It will likewise not be found wanting on muddy or rocky roads; and owing to its being equipped with solid tires, which of necessity precludes any tire trouble, it is a great favorite with physicians and other men requiring a machine of extreme reliability.



THE HOLSMAN AUTOMOBILE WITH WIRE-ROPE DRIVE.

This machine is one of the most successful of the "horseless carriage" type. It is propelled by a double-opposed-cylinder air-cooled motor having two different speed reductions to the countershaft.

THE LAMBERT FRICTION DISK TRANSMISSION AND SHAFT DRIVE WITHOUT UNIVERSAL JOINTS.

A, B, C, D, E. Levers, sleeve and connections for pushing disks in contact. *D'.* Band brake. *F.* Flywheel disk. *G, H.* Bearings of countershaft. *J, K.* Bevel gear and propeller shaft housing. *L.* Disk-shifting lever for changing speeds. *M, N, S.* Connections and curved lever for shifting wheel, *W.* *O.* Muffler. *R. R.* Radius rods. *P. T.* Timer and connection for shifting same. *V.* Steering column. *Y, I.* Clutch pedal and locking spring. *Z.* Brake pedal.

A SUCCESSFUL FRICTION-DRIVE AUTOMOBILE.

For several years past the friction disk form of variable-speed transmission has been experimented with and used with satisfactory results by a number of western manufacturers. Perhaps the most successful, at any rate the most up-to-date, application of this form of transmission is that found in the Lambert car built by the Buckeye Manufacturing Company, of Anderson, Ind. Combined with an extremely simple propeller shaft and bevel gear drive, and deriving power from a 40-horse power motor, this transmission offers many advantages, chief of which are simplicity and lack of expensive up-keep.

The Lambert touring car has the general appearance of any high-grade 4-cylinder automobile. The large view of the transmission printed below shows practically all the working parts of the car. A very large motor flywheel faced with aluminium (*F* in the illustration) is made to serve as the driving disk, while a large spoked wheel, *W*, having a ring of compressed paper, *X*, bolted to its periphery, acts as the driven. This latter wheel can be slid on its shaft across the face of the driving disk. On one side the reverse is obtained, while when it is slid to the other side of the flywheel, the forward speeds can be had. The lever, *L*, which moves over a quadrant whose notches correspond to the different speeds, operates the long, curved, shifting lever, *S*, by means of the smaller lever, *M*, and the connection, *N*. By sliding the wheel, *W*, from the center to the outside of the flywheel, *F*, any speed from a crawl to 45 miles an hour can be obtained with the motor working at full power. After the wheel, *W*, has been slid to the proper place, it is brought against *F* by a push on pedal *Y*. This pedal, through a connecting link, *A*, and lever, *B*, turns the hollow shaft, *C*, which has at each end short levers connected by links, *D E*, to the pivoted bearings, *G H*, of the transverse shaft. The result is that the whole shaft is moved bodily forward and *W* is pressed against *F*. The pedal is held where set by means of a locking spring, *I*, that travels over a notched track. By pushing on the upper edge of the pedal, the locking spring is released and the pedal, and consequently the transverse shaft, are both drawn back by a spring. This pedal corresponds to the clutch pedal of any ordinary car, but it is exactly opposite in its action. The pedal, *Z*, operates an expanding brake in drum, *D'*, on the transverse shaft, and is interlocked so as to break the contact between *F* and *W* when it is applied. The outer hand lever works, through an equalizer on the differential casing, two expanding brakes in the hubs of the rear wheels.

The new model Lambert car has the shaft drive shown herewith. By employing bevel gears at each end of the propeller shaft, no universal joints are needed, as the up-and-down movement is allowed for by the bevel gears and any slight forward thrust that might occur is withstood by two tubular radius rods, *R R*. As universal joints are dispensed with, the driving shaft can be completely incased in a tube, *K*. Miter gears are used within the case, *J*, instead of the ordinary bevels that are used at the other end of the driving shaft. A bevel gear differential and divided rear axle are employed. The motor is a 4½ x 5 4-cylinder Ru-

(Continued on page 53.)

charge. A slight comparison of the duties of this valve with the crankshaft of the same engine is interesting. The area of the 5-inch piston is approximately 20 square inches, while the area of the exposed surface of the valve is but a little over one-tenth this amount, being less than 2¼ inches. The bearing surface of the valve shaft extends the full width of the cylinder, whereas the bearing surface of the crankshaft does not total one-half of this amount, because of the crank-sides and crankpins which must be provided for. From this it will be seen that the work done by the valve is but 1/20 the work done by the crankshaft, and yet to provide ample packing surface, the valve diameter and consequent surface is 30 per cent greater than the crankshaft diameter. From this comparison, as well as from the results given in practice, it is readily seen that the life of the valve should be very long under normal usage.

Experiments have been made with tapered valves fitting their bushings as does an ordinary stopcock, but trial of both kinds has convinced Mr. Duryea that even the slight added cost and complexity of the tapered form is not necessary to secure the desired results.

In service, the rotary valve engine runs almost like a steam engine. The mechanical operation of the inlet permits perfect admission of the attenuated charge admitted at low throttle, and secures a wide range of speed because of this smooth running at low speeds, as well as because of the lack of reciprocating parts, which clatter and pound badly at high speeds. The crankshaft bearings are made quite large, and the connecting rods are forged and of so strong a design that high speeds cannot damage them.

The prediction is freely made that this invention is one of the most marked improvements in the four-cycle gasoline automobile motor that have been made in recent years. Mr. Duryea has several patents pending upon this device.

THE 50-HORSE-POWER NORTHERN ENGINE.

(*Continued from page 25.*)

arate steel pan. Nipples screwed into the cylinders just above the highest point of piston travel carry horizontal pipes with three vertical outlets, the center one of which carries a spark plug, the right-hand one a priming cock, and the other a patent relief valve for each cylinder. The relief valves are all connected together so that the chauffeur can, by pulling a handle, put them all in operation when turning over the engine. These valves only open when the compression occurs, and as soon as an explosion takes place, they instantly close.

The motor is started by a long lever having a pawl that engages the teeth of a ratchet wheel on the crankshaft. The movement of the lever in starting the engine automatically retards the spark. The two-to-one gears are shown incased at *T*, and are used as a water pump to force the cooled water received from the bottom of the radiator through the large pipe, *W*, leading to the bottom of the water jackets. The bracket for the fan belt pulley, seen at the front end of the engine, is mounted on a vertical spindle that can be raised or lowered by turning the star wheel on top. Thus the fan belt can be easily and quickly tightened. The cylinders of the Northern engine are slightly offset, which gives a more direct thrust on the working stroke.

A SUCCESSFUL FRICTION-DRIVE AUTOMOBILE.

(*Continued from page 26.*)

tenber engine rated at 40 H. P. at 1,000 R. P. M. The timer is shown at *T*. *P* is one of the connections between the timer and the base of the steering column, *V*, for advancing the spark by means of one of the levers that travel over the stationary segment in the steering wheel. The motor is provided with an 8-feed mechanical oiler, which efficiently lubricates it.

A NOVEL INDIVIDUAL CLUTCH TRANSMISSION.

(*Continued from page 29.*)

the end of the sliding shaft, *C*, the ends of which press the internal expanding wedge, *M*, forward, thus causing the four wedge pins, *K*, to protrude beyond the periphery of the shaft, *C*, opening the frictions, *AA*, against the internal wall of the bronze ring gear, *B*. This action makes the whole mechanism integral. To change the speed the sliding shaft is simply located under any gear desired and the operation repeated. *D* is the differential from which the jack shaft, *J*, protrudes from either side, to the sprockets. The reverse is accomplished by an intermediate gear which is located in a pocket at the bottom of the case under another gear (which is shown as not in mesh and on the shaft, *E*.)

THE GROUT 35-HORSE-POWER CHASSIS.

(*Continued from page 31.*)

tion is by accumulators and a single spark coil. The high-tension distributor is combined with the commutator, *C*, which is operated by a lever in the steering wheel. The muffler appears at *M*. The engine and transmission are mounted on an angle steel sub-frame, as shown.

Levers *A* and *B* operate the three-speed progressive sliding-gear transmission and the expanding emergency brakes on the rear wheels. The former lever is connected through the horizontal lever, *D*, with the sliding rod, *R*, that extends into the gear case, and shifts the gears, while the latter lever, *B*, when drawn toward the driver, applies expanding brakes in the rear wheels. The pedal, *E*, operates the contracting brakes on the rear wheel hubs, while the pedal, *F*, controls the clutch, which is of the ordinary leather-faced cone type. There is a large universal joint, *U*, between the clutch and the gear box, and the countershaft is provided with Oldham universal couplings between the gear box and the frame. One of the driving sprockets on the countershaft is seen at *J*. A cylindrical gasoline tank of 15 gallons capacity is placed under the front seat, and the pipe, *P*, extending from its lowest point to the carbureter, feeds the latter by gravity.

THE NORTHERN FOUR-CYLINDER 50-HORSE-POWER CAR.

(*Continued from page 34.*)

son, the Northern Motor Car Company has placed on the market a 50-horse-power car embodying all the essential features of the air control. Clutch and air control features remain practically the same as last year, with the exception that the parts are increased in proportion to the larger car, which is rated at 50 horse-power.

It will be noticed that the entire control is placed on the steering column, and that all side levers are omitted. The gear-shift lever is placed horizontally just below the steering wheel, and the small lever which operates the shift gears controls the clutch. A slight turning motion of the hand grip on this lever throws in or releases the clutch. It will be seen that practically the same motion that shifts the gears operates the clutch at the same time. The reverse operation is taken care of with the right foot by pressing on a pedal projecting from the steering column. This reverse position is interlocked in such a way that the reverse can only be operated in a certain position of the gears. The transmission is placed on the rear axle. It is very compact, and runs on roller bearings of the Timken type. Easy adjustment and accessibility are marked features of this arrangement. Ball bearings are provided for the steering spindles as well as the worm and segment mechanism, which renders steering very easy.

Special attention is directed to the pivotal rear platform spring, which permits of either of the rear wheels passing over an obstruction without imparting any shock to the car frame. It will be

(*Continued on page 56.*)