oiled by a mechanical lubricator. It has two vertical 5 x 5 cylinders, and is rated at 16 horse-power. Its crankshaft is 2 inches in diameter and is a steel drop forging, as are also both axles of the car, which are of an I-beam section. The wheels are fitted with 4½ x 30-inch solid tires. The Olds Company also makes a lighter delivery wagon fitted with a single-cylinder motor of their well-known type. An automobile express company located in Detroit has used these cars for the past six months, and has obtained excellent results. One machine missed but one trip out of 198, and that owing to laying the machine off for some slight adjustments when it could have been run. The average cost of operation, including wages of the driver, was found to be 4.2 cents per mile, and the cost per package for delivery about 3 1-3 cents.

For the past three years, at Christmas time, the Olds Company has placed at the disposal of the postmaster of Detroit several of its delivery wagons for use in delivering and collecting mail matter and transferring it to the different sub-stations. During the holidays, recently, four delivery wagons were used. The postmaster informs us that "the service rendered by these machines was on the whole very satisfactory, and their use was instrumental in securing the delivery and collection of large quantities of mail matter in a very short period of time, and they were also of material assistance in the matter of making quick special trips to our station postoffices. It is, no doubt, a fact that the aforesaid congestion would have burdened the office for one or two extra days had not these machines been employed."

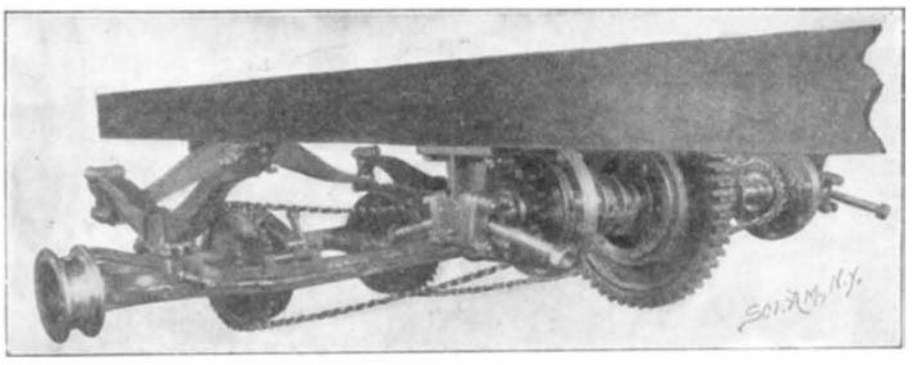


Fig. 1.—Differential Countershaft and Rear Axle.

The Countershaft carries three Differentials, and Drives by Chains the Sprockets of Universally-jointed Shafts which Revolve the Rear Wheels; the Front Wheels are Driven in the same way.

A GASOLINE TRUCK DRIVEN BY ALL FOUR WHEELS.

The Four Wheel Drive Wagon Company, of Milwaukee, Wis., has been experimenting for something over a year with a gasoline motor truck which drives by all four wheels. The illustrations shown herewith give a good idea of the appearance of the truck and its mechanism. It has been given tests in snow, through which it showed its ability to travel without the least hindrance, although the snow in places covered the axles and more than half of the wheels. It demonstrated the theory that a machine driving all four wheels independently will not slip its wheels, and will be able to travel through roads impossible to negotiate by a two-wheel drive, although its tires are neither corrugated, spiked, nor roped in any way, nor have they any special anti-slip device of any kind.

The machine shown will carry five tons. But while this machine is a chain-driven machine, the 1905 model, which is now being gotten out, will have a bevel gear drive throughout, the chain drive being superseded by this type of drive except for exceedingly heavy trucks.

The theory that the additional machinery necessary for driving four wheels as compared with driving two wheels would produce more extra friction, and consequent loss of power, than the value of any advantage which might be gained by a four-wheel drive, has been demonstrated to be false entirely in this machine, for it is possible to move this 6,000-pound truck up and down the shop floor by simply turning the starting crank; and there seems to be very little difference in the power needed to turn the starting crank, whether the engine alone is being turned or the entire driving mechanism.

Our illustrations give a fairly comprehensive idea of its appearance and construction. A four-cylinder, 5 x 6 Rutenber gasoline engine of 25 horse-power is mounted transversely in front, and drives by a Morse silent chain a three-speed sliding-gear transmission immediately behind it. Another chain extends from the transmission to the differential countershaft placed at the center of the chassis. This countershaft has a large differential in the center, and a smaller one at each end. The large differential takes care of the difference in movement on the two sides of the vehicle, while the small ones equalize the difference between the front and rear wheels, on either side. Sprockets on the hubs of the smaller differentials drive through long adjustable chains the sprockets on the four drive shafts which are connected to the outer face of the wheel hubs through universal joints in said hubs. The outer ends, *E*, of the axle frames are shaped as shown in Figs. 2 and 3. Taper pivot pins, *PP'*, project through holes in the top and bottom of each axle and in the central hub cone-carrying ring, which is flattened on opposite sides so as to fit on the corresponding top and bottom part of the axle end. The bottom flattened portion of this ring (*T'*, Fig. 5), as well as the pivot pins passing through the axle end, and half of the universal joint, *U*, of the drive shaft within it, are plainly visible in Fig. 3. The cone ring, *T*, has the steering lever-arm, *S*, cast integral with it, this arm being behind the hub in the photograph, Fig. 2. Two cone rings, *C'* are mounted on this ring, *T*, and the cups that match are on each side of a center lug of the L-shaped hub ring, *O*, Fig. 5. Upon this ring, *O*, are mounted segments of wood, which are bolted to it by bolts passing through it and the detachable outer flange, *R*, Fig. 5. These segments are also bound together near the periphery by shouldered rings, *SS'*, bolted on. In putting together the wheel, the inner ring of balls is first assembled on the cone, *C*, of ring, *T*, Figs. 3 and 5. Then the wheel proper, which is built up on ring, *O*, is slipped on, the central lug on the bottom of *O* coming against the right-angled race of one ring of balls. The other ball bearing is then put in place, and both are held in by a retaining ring, which is screwed into place.

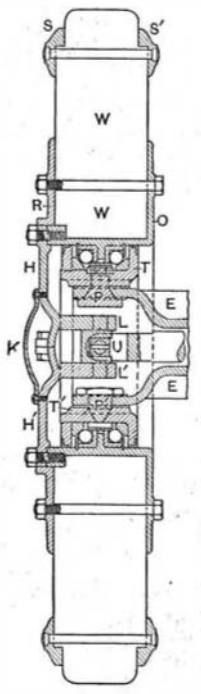


Fig. 5.—Cross-Section of Wheel.

Experience has shown wood wheels of this sort to be cheap and durable for all heavy work. The wheel is driven through a detachable outer hub plate made in two halves (*H* and *H'*, Fig. 5). These halves have lugs, *L* and *L'*, which are assembled around one fork of the universal joint, the other part, *U*, of which is seen in Fig. 3. *H* and *H'* are bolted together and to the outer hub binding ring, *R*. A light hub cap, *K*, completes the hub. In the new model the brake bands will be on a drum on the wheel hub instead of on the sprocket, thus removing from the universal joint the braking strains and leaving it only the driving to do. The brakes, of course, are all connected and balanced by adjustable rods. They are operated by a pedal. By removing *K* and *H H'*, the wheel can be readily removed, as well as the driving shaft. The wood part of the wheel can also be replaced readily at will.

The truck is controlled entirely from the driver's seat. So great is the combined tractive effort of the four wheels, that the machine can be started with its front wheels against the curb, and it will mount it at once, apparently without effort. A very strong company will manufacture the new trucks, which, from present appearances, will meet with as great success as they certainly merit.

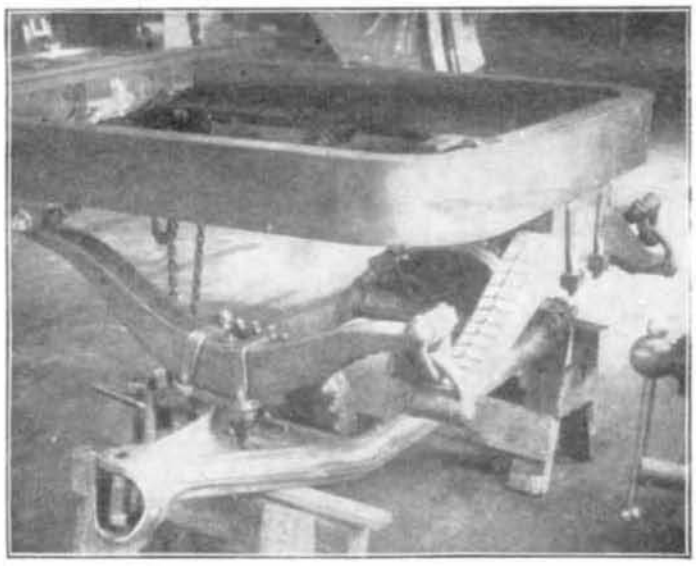


Fig. 2.—Rear Axle, Showing Flattened End for Wheel to Turn on, and Driving Sprocket Behind Spring.

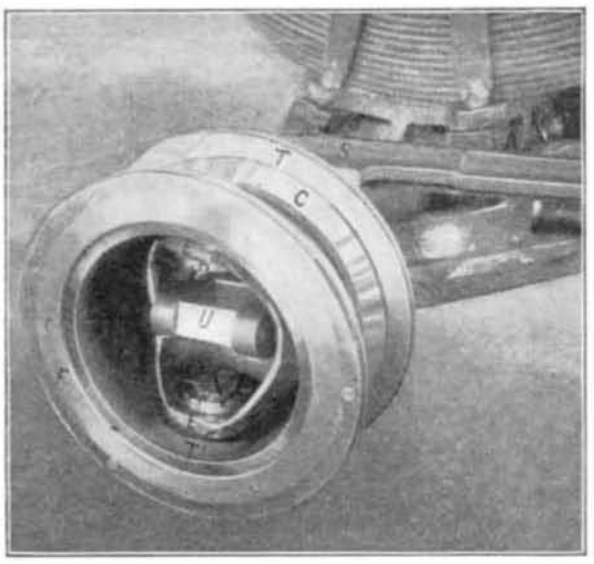


Fig. 3.—Ball Cone-Ring Forming Hub, Assembled on Axle End.

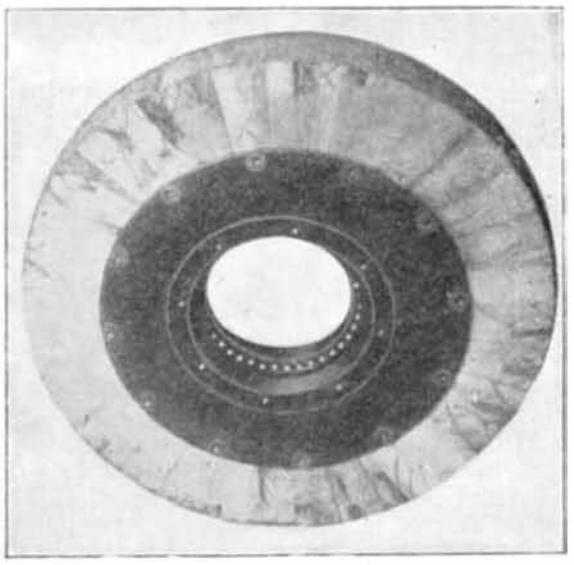
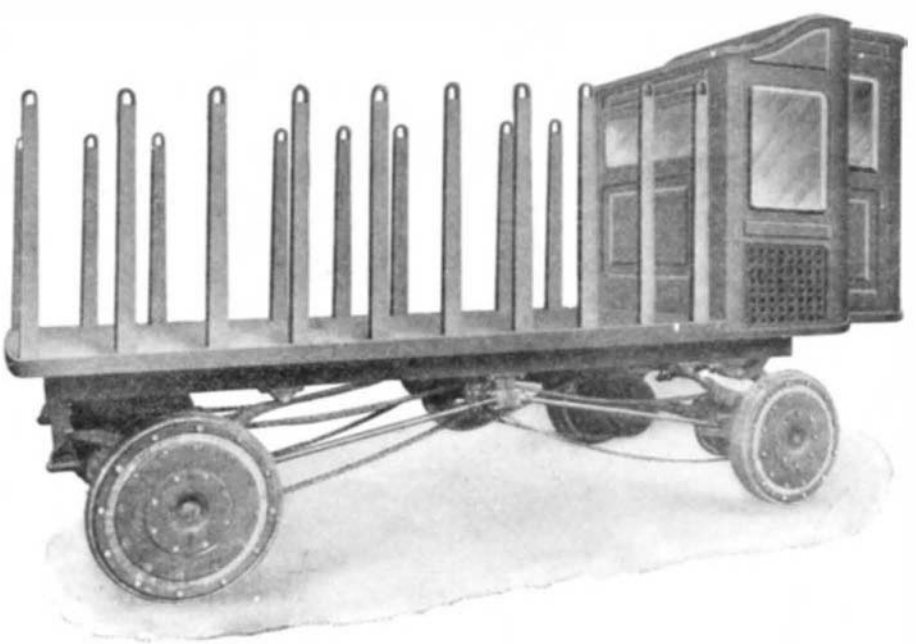


Fig. 4.—Wheel Formed of Wood Segments, Showing Ball Bearing in Hub.



FIVE-TON GASOLINE TRUCK DRIVEN BY ALL FOUR WHEELS.

Paraffin is employed for waterproofing paper. Wax may be used also but is more costly. Either may be applied by melting and drawing the paper through the liquid.—Drug. Circ.