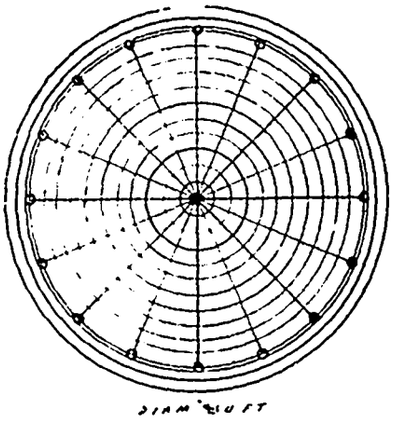

'tricolor' of the French; while on a day of national mourning, as when we lose our beloved Sovereign, it may be painted and draped in black or white and black, or all in white, as on the birth of another heir to the throne."

## THE MOTOR VEHICLE—IDEAL AND REAL.

Regular readers of THE CANADIAN ENGINEER need not be told that this journal is interested in the new development of inventive industry in connection with the autocar or horseless vehicle, and that we have faith in the outcome of inventive efforts along this line. Since the editor returned from England last autumn, and wrote his impressions, we have published nothing special as to motocycles, for the very good reason that no radical improvement has since been made. We think our readers may be interested in a review of the situation as it is at present, gathered from the various journals of the motocycle industry, from the published data as to tests, and from interviews with practical mechanics and electricians who are wrestling with the knotty problems involved.

Let us first say that the essentials for motocycle work are: (1) power, (2) control, (3) speed. These essentials are given in the order of their relative importance. *Power* must be sufficient for overcoming hills and holes, sand and snow, rain and ruts. The power required on a good level road for 2½ tons of vehicle and load would be about 2.5 horse-power for a speed of eight miles an hour, or about 3.75 horse-power for a speed of twelve miles. To mount a hill, some parts of which may be on a gradient of 1 in 20, the 2.5 horse-power rises to 10.5 horse-power; but if a speed of three miles per hour were deemed sufficient for climbing the gradient of 1 in 20, only about 4 horse-power would be required. But for bad roads these quantities ought to be doubled, so that to take 2½ tons of vehicle and load up a gradient of 1 in 20, at eight miles an hour, would require about 20 horse-power, or at low speed about 8 horse-power. These conservative figures, taken from an English engineer, should be kept constantly in sight by inventors; and it might be added that even on ordinary level roads there are occasional short grades much steeper than 1 in 20, whereas sidewalk crossings run 1 in 10. *Control* is important both as to speed and as to steering. In the Chicago contest one motorman became unconscious because of the great strain of manipulating the steering apparatus. *Speed* is the third element, but has no value except in conjunction with power and control. The more speed we get, the more urgently must we insist on control. High rates of speed may be permissible, even advisable, with an extremely perfect control; and it is possible that a method of control may be yet secured that is even more tractable than a horse; but it is not here yet. The control of electric vehicles, not being limited to fixed speeds, is preferable to that secured by differential and frictional gearings, both of which are antiquated, though the latter is advertised as a novelty. The practical difficulty with frictional gearing on an autocar is that there is insufficient grip when it is most needed, viz., when special demand is made for power.

The motive powers which have been tested on autocars may be named in order of merit: (1) *Explosives*, including petroleum, acetylene and gunpowder. (2) *Electricity*, primary and storage. (3) *Steam*. (4) *Compressed Air*.

It is next to impossible to get reliable data on autocars. Readers must winnow a bushel of chaff to get one kernel of wheat. The only really reliable mechanical data we have is that furnished by the judges in the *Times-Herald* contest in Chicago last November. The Duryea gasolene motor made the highest record on practically all points, and we may, therefore, take this as high-water mark up to date. What do we find? The vehicle (seating two persons) weighed 1,208 lbs.—and this, by the way, was the lightest of all the vehicles entered. Two runs were made with her on the testing machine, giving draw-bar strains of 83 and 88 lbs. respectively—these being the records of the motor while running under its best conditions. At these draw-bar strains, 1.10 and 1.16 horse-power was exerted at the rim of the driving wheels, at a speed of less than five miles per hour; a mechanical efficiency of 65 per cent.; a consumption of 3.64 and 3.24 lbs. of gasolene per h.p. per hour, giving a cost per h.p. hour at rim of wheel of 7.28 cents and 6.48 cents. As the Chicago judges remarked: "It is apparent that the heaviest pull exerted, namely, that with the Duryea vehicle, amounted to only 187 lbs., as compared to 400 lbs. which a single horse could exert. . . . For the purpose of determining roughly a probable value, an express horse of average type was tested by your committee, and without resorting to violent methods of persuasion, the maximum pull obtainable was found to be about 250 lbs. It is probable that 400 lbs. is about the maximum of a good horse. On the other hand, when the pull is light a considerable range of speed may be obtained, and the measure of the power exerted by the horse at all times may be obtained by multiplying the pounds pull by speed in feet per minute; dividing this by 33,000 gives the ordinary unit known as a horse-power." Taking this method of calculation with the Duryea motor, the best result is about half the draw-bar strain that a good horse could exert.

It is quite evident from the above figures that although the price of motor carriages ranges from $1,000 to $1,500, their actual efficiency for work on roads other than asphalt is less than that of a horse which could be bought for about $25. The only hope of popularizing the horseless vehicle, at least for the present, is by producing something infinitely better than an ordinary horse.

As to acetylene and gunpowder, these are two very desirable fuels if they can only be kept reasonably cheap, but thus far the indications are against this.

As to electricity from storage batteries, there are many advantages such as cleanliness, simplicity of manipulation and control, absolute safety, and absence from vibration; but as shown by the Morris & Salom