capable of building modern ships from wood, but do not read drawings well, still less are they able to calculate from them, and all this without assistance from Europeans. Most of the vessels are of wood, imported from the Philippine Islands, for China is a treeless country, and the native workmen understand the handling of these woods better than any other people in the world.

There are plenty of workshops in China where there is not a single European employed, and the author of the paper says they are very docile, learning readily the methods pointed out to them, with no predilections for trade unions. There are some very able draughtsmen to be found among them, and but rarely, mathematicians. The ship owners themselves are said to be very easily satisfied and pay no attention to the construction of their vessels, their supervision being wholly confined to seeing that they get the scantlings they pay for.

It is a mistake, says the author of the paper, to assume that the Chinese are so conservative they will not adopt new ideas; they are very ready to do so after the utility of them has been proved by someone else. They are not experimenters, but discover things by accident or evolution, and, so far as the laws of the country permit, will use any process or machine that has been demonstrated to be of practical value.

Red Dust Analysis.

Mr. Barac, in the Journal of the Meteorological Society, gives an analysis of a sample of the dust which he collected at Fiume (Hungary) on the 10th of March during the red dust-shower known as the "rain of blood." The dust analyzed as follows:

	Per cent.
Silica	49.49
Sesquioxide of iron	9.96
Alumina	12.10
Peroxide of manganese	1.99
Lime	11.46
Magnesia	0.40
Carbonic acid	8.96
Organic matter	5.48

Also traces of soda, sulphuric and hydrochloric acids, etc. With a microscope of 640 diameters M. Barac found that the principal mass was colorless, with colored particles of irregular form partly made up of angular fragments of crystals, also mineral particles and silicious skeletons of micro-organisms, and lastly particles of soot. A further examination showed the existence of well-formed rhombohedra of calcite and cubes of common salt. As regards size, the crystalline particles varied from a minimum of 0.00004 inch to 0.00007 inch mean and 0.002 maximum, while the yellow and structureless particles reached 0.00046 inch.

THE EVOLUTION OF THE MOTOR CYCLE.

BY HROLF WISBY.

Only a few years ago it would have been impossible to secure an efficient, safe, and practical motor cycle. It is only within the last two years that this special industry has shed its experimental swaddling clothes. It is now at a stage when the standardizing of essential features, the interchangeability of parts, and the comparative unanimity of design has put it on a practical mechanical and commercial basis.

France led the way. She was the first to produce a practical motor tricycle. In England, where the three-wheeler has always been popular, the makers were quick to follow suit. In this country three notable bicycle manufacturers produced mechanically successful patterns of motor tricycles, which, however, failed to attract the public, doubtless for the reason that the three-wheeler has never been a favorite here.

The motor bicycle, however, supplies the hitherto "missing link" between the bicycle and the automobile, between the poor and the rich of the speeding sport. It makes its owner feel that he is still a wheelman in spite of the snorting motor on his wheel, and when automobiles of much larger horse power try to pass him in vain on the road he is pleasantly reminded that he is in it and able to hold his own among the swift company of the automobilists. That, too, has something to do with the popularity of the motor bicycle. It is far cheaper to operate than the smallest launch, it is much less liable to get out of order than the most reliable type of horseless vehicle, and it is the swiftest and most economic vehicle known in proportion to weight, carrying capacity and fuel consumption.

A SIMPLE COMPARISON.

A motor bicycle weighing only sixty pounds, of 1½ horse power, will easily and safely carry a man weighing 180 pounds across the average kind of country road at a maintained speed of from twenty to twenty-five miles an hour. The automobile has not been built which, weight for weight and proportionate power, could come anywhere near this performance. When it is considered that the factor of safety in steel bridges is four, or, in other words, that a bridge to be safe must be strong enough to sustain four times the sum of its own weight and the live load, the fact that the motor cycle is able to carry three times its own weight and over, in addition to propelling this load at a rate of speed prohibited on most bridges, and by virtue of a comparatively small horse power, we begin to appreciate the amount of practical science involved in the building of the motor cycle.

SOME SPECIAL DEVELOPMENTS.

When the English Singer motor tricycle was first introduced, it was ridiculed as a toy of very little practical use. Wheelmen jeered at the idea of comprising the motive power within the front steering wheel, and automobilists—don't ride motor cycles. It was soon found, however, that this unsightly but reliable machine would carry its passenger over British roads at a twenty-mile clip with no material drawback except the liability of the steering wheel to be jerked from side to side in traversing rough pieces of road.

Another quite characteristic, but not so very reliable development, is evident in the English Derby motor bicycle, which transmits power directly to the rear-wheel tire by means of a spur-gear contact arrangement.

Among other interesting foreign types may be mentioned the Werner, which has a belt-driving motor attached on the steering head and outside the frame; the Minerva, of practically the same construction, with a belt-driving motor on the bottom frame tube flush with the crank-hanger; and the Rex, chiefly remarkable for an aluminium bed fixed on the bottom frame tube, to which the motor is bolted.

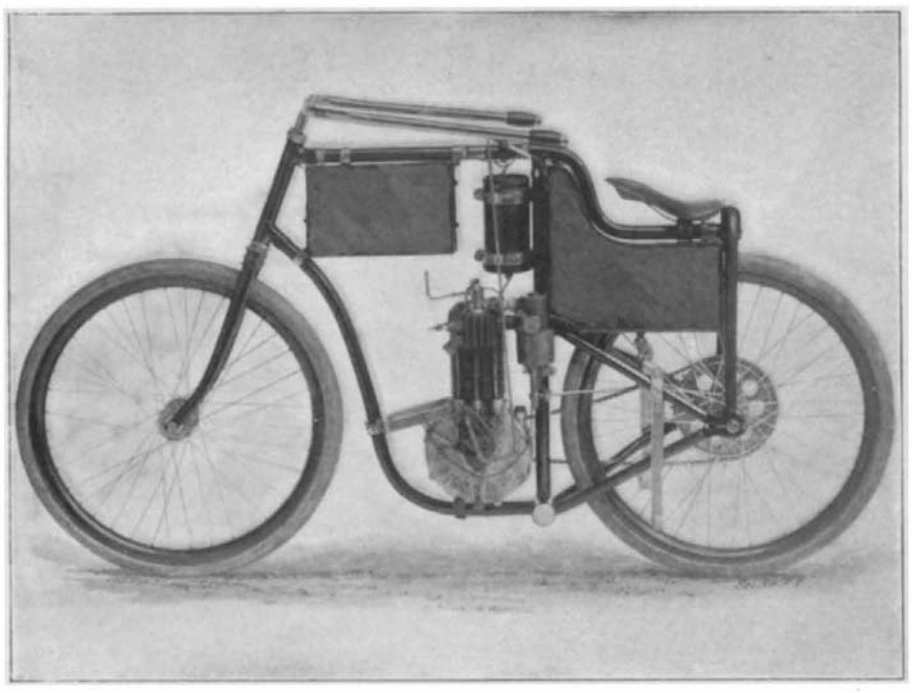
SUPERIOR DEVELOPMENTS.

If we will regard these various phases of motor cycle construction as forerunners of the distinctly superior developments as evidenced in the 1902 models of the leading American makes, we shall be in a position to better appreciate the advance made by our makers.

It is difficult to say which is most popular in this country, the chain or the belt-driving motor cycle, though present indications point to the obvious desirability of the belt driver. A round rawhide belt insures a smooth and much less jerky pull than a chain. It is considerably cleaner, not quite so liable to break, and permits of almost instant adjustability. With a

The Patee Motor Bicycle (1½ H. P.)

The Mitchell Motor Bicycle (2 H. P.) with Flexible Rawhide Belt.



The Stearns Racer (3¾ H. P.)

A French Motor Tandem for Pacing. (Combination Gasoline Tank and Wind Shields.)

belt drive it is an easy matter to change motor pulleys from, say 4 inches for hard road work, to a 5-inch or 7-inch size when the roads are fine, or for speeding on the track.

Although the several patterns of American chain-driven motor cycles differ ostensibly in model, and rationally in various constructive details, they may, on the whole, with propriety be classed together as belonging to the frame-contained motor chain driver, that is, the motor is invariably placed within, and never without, the frame. The Stearns, the 1902 racing model of which is herewith shown, is a type of the chain driver. This odd-looking machine was designed especially for speed to replace the motor tandem in furnishing pace to the racing men. The rear wheel is very wide, the hub measuring 11 inches in width. This arrangement serves to shield the rider following the machine against any undue wind pressure. In order to get the saddle down as low as possible, to further screen the rider, it is clamped directly to the upper frame tubing. The operator sits directly over the rear wheel, in easy reach of the motor, managing the steering by means of a brace of huge, elongated handle bars. The absence of pedals on this machine is explained by the fact that they are entirely superfluous for racing. The operator does not in any way aid the progress of the machine. There are two foot rests or stirrups into which he is supposed to put his feet. A De Dion 3¾ horse power motor furnishes ample power to send this machine around the track at more than fifty miles an hour. The motor is of the high-speed pattern, making from 600 to 2,000 revolutions a minute, and the gear is 132 inches. The weight of this machine, which was recently built to pace Jimmy Michael, is 165 pounds.

Among belt-driving motor bicycles, the Mitchell is undoubtedly the most characteristically American model, being in simplicity of design, ease of handling, and efficiency of power decidedly superior to any foreign machine, and unexcelled by any domestic make. I am speaking particularly with reference to the 1902 Mitchell model, the beautiful lines of which are herewith illustrated. The motor has a 3x3 inch cylinder, makes 1,800 revolutions per minute, developing an actual brake test power of 2 horse power, or, in other words, 3 to 3½ horse power as motors are usually rated. This power is sufficient to propel the machine at speeds varying from five to thirty-five miles in the hour. The frame is made of heavy-gage seamless steel tubing, and being only twenty-four inches high is exceedingly convenient. The hanger is dropped 2½ inches, and the wheel base is only 45 inches, making a very compact and strong design with no suggestion of clumsiness. In order to more perfectly balance the load and secure a long belt pull, the motor has been placed within the frame head directly under the rider's control, which position at the same time precludes the possibility of "skidding"—a not uncommon feature with machines having low-mounted motors.

The fuel feed is extremely simple and easy to manipulate. It is of the so-called "drip feed" system, which does away with the troublesome carbureting devices so common on foreign-built machines. Instead of the ordinary surface carbureter, a feed pipe is led direct from the gasoline tank into a small vaporizer. The quantity of fuel administered in this way is regulated by means of a small thumbscrew with a pointer on an index dial indicating the amount of gasoline fed to the vaporizer. The air inlet is fixed, the volume of air taken into the vaporizer being gaged by the working piston. Instead of the usual throttle valve between the carbureter and the engine, a drip feed of gasoline is introduced through the vaporizer into the engine by the suction stroke. There could be no more direct and simple form of liquid fuel feed. After filling the fuel tank with ordinary gasoline, and the lubricating tank with engine oil, the operation of the motor is effected by opening the valves of these respective tanks, besides the compression cock. The machine may now be mounted. After a few revolutions of the pedals, simultaneous with turning the left grip, which serves as a switch, to the right, three or four sharp explosions are sure to follow, whereupon the compression cock should be closed, and the motor will now carry the machine along at a slow, steady pace. Speed is increased by moving the handle of the "sparker" forward; speed is decreased by moving the handle backward; to slow down temporarily the switch may be turned off, and to stop the machine altogether the current is shut off by turning the left grip toward the left and at the same time applying the coaster brake by pressure on the pedals. On coming to a stop the sparking plug is taken out, the gasoline and the lubricating oil valves are turned off, and the compression cock is opened. These movements are exceedingly simple and elementary, and after practising the rudiments of operation a few times any ordinary wheelman will find himself in reassuring control of the machine. Among the improvements in the 1902 Mitchell is a ball bearing idler, a speed device placed conveniently for manipulation, and a valve lifter. The mixer used in connection with the motor has the merit of not being affected by travel over rough roads, like the ordinary kind of carbureters. This machine, while not a racer, is powerful enough for all touring purposes. The efficiency of the motor enables the operator to climb almost any hill, plowing through sand, and going against head winds at a fair rate of speed, while on good roads upward of thirty-five miles an hour may be negotiated. Fully equipped for touring, with 1¾-inch five-ply tires, the machine weighs 110 pounds. The tank capacity of the reservoir is seven pints, which is ample fuel for a distance of 65 to 75 miles.

The motor cycle industry may as yet be in its infancy, but it is, nevertheless, capable of producing machines like the above which are daily demonstrating a high degree of efficiency and reliability in practical work on the road.

International Geographical Congress.

Baron von Richthofen, the famous professor of geography in the University of Berlin, has just informed President Alexander Graham Bell, of the National Geographic Society of Washington, that the Executive Committee of the Seventh International Geographical Congress, which was authorized to make arrangements for holding the next meeting, has accepted the invitation of the Washington society to meet under its auspices at our national capital. The Congress will not be held till 1904 and there will therefore be plenty of time in which to arrange a programme of great interest and value. It will be the first meeting of the International Congress in the Western world and undoubtedly a large number of the foremost geographers of Europe will be present.

The society under whose auspices each congress is held has charge of the arrangements. The National Geographic Society, accordingly, will have nearly everything to do with the selecting of topics that will be most prominent in the deliberations of the congress. It will select men who are authorities in their special lines of geographic study to read papers and lead in the discussions.

Before the congress meets, the large and handsome home of the National Geographical Society will have been completed in Washington. The building is named in honor of the late Gardiner G. Hubbard, the founder and first president of the society, who lived to see many hundreds of persons, interested in geographic science in all parts of the country, enrolled among the members.

Baron von Richthofen, in his letter accepting the invitation of the Washington society, says: "There is, indeed, no place better fitted for geographers to assemble than Washington, which is the great center of scientific geographical exploration in America and the distinguished workshop of a considerable number of eminent men."

A conspicuous feature of these congresses has been a geographical exhibition containing a great variety of objects illustrating the world's progress in topographic and geodetic surveying, map, globe and relief-map making, the production of text books and other school appliances and so on. This feature was omitted in the last congress, held in Berlin, but it will be an important additional attraction if such an exhibition is held in connection with the Washington meeting. It would certainly be helpful to the geographical interest of this country if such a collection should be formed in Washington and permanently maintained there under the auspices of the National Geographic Society.

The society has had the assurance from the other geographical societies of the country of their hearty co-operation in making the meeting of the congress a success. The geographers of Washington express the hope that it may be found practicable to hold sessions of the congress in a few other cities in conjunction with their geographical societies. Such a meeting should certainly be held, if possible, in this city, where the American Geographical Society is about to open its new building on West Eighty-first Street. The edifice which this society has just completed is believed to be the most commodious and attractive structure occupied by any geographical society. It is a fitting home for the fine library which represents a half century of book collecting; and it offers facilities for reading and work that were not available in the smaller house so long occupied on West Twenty-ninth Street. Boston is the home of the Appalachian Club, Philadelphia of the Philadelphia Geographical Society, and Chicago, San Francisco and Seattle also have their geographical societies.

Excursions are always a prominent feature of these congresses. The Washington society expects to offer its guests an attractive series of excursions to points of geographic interest. Washington is centrally situated in respect of natural features that appeal to geographic students. Niagara Falls, the Natural Bridge of Virginia, Luray and Mammoth Caves are within easy reach. It is probable that one of the excursions will be to the Pacific Coast.

The preparation for one of these international congresses involves an enormous amount of labor, but since the first congress was held in Antwerp in 1869 they have been found to be worth all they cost in the geographic results attained and the opportunities they have afforded for social intercourse among the foremost workers in this field of knowledge. The National Geographic Society will certainly spare no effort to make the coming congress a success; we may look for a very large convocation of geographers here in 1904, says the New York Sun.

HYPNOSIS IN FROGS.

Hypnosis in animals is a question that has been very little studied. At the Fifth International Congress of Physiology, which recently met at Turin, Mlle. M. Stefanowska, of Brussels, read a very interesting paper upon this subject entitled "The Conditions Favorable and Unfavorable to Hypnosis in Frogs," and of which the following is a brief abstract.

Frogs that have remained in an aquarium during the winter afford excellent subjects for the study of hypnosis, at the moment when they are thoroughly exhausted by a prolonged fast, that is to say, in spring and early summer. As soon as they are turned upon their backs they fall into a hypnotic state which often reaches that of catalepsy. In a state of profound hypnosis, the action of the organs of the senses is suspended and the kinesthesic sense is greatly blunted, as is also the sensitiveness to pain. The pupils are always contracted, but dilate as soon as the animal awakens. The cardiac motions slacken and the respiratory ones are often scarcely perceptible. Such a state may persist for half an hour or more.

Profound hypnosis is still more marked in winter frogs when their body has lost much water in consequence of a stay in a dry place. Such frogs cannot always be awakened at the moment desired.

Frogs captured in spring undergo hypnosis under the same circumstances, but are more resistant. They become more and more hypnotizable in measure as their fast is more prolonged. This fact accords with the observation of Gley that hypnosis is easily produced in frogs that have grown lean. According to Mlle. Stefanowska, exhaustion, a prolonged fast and the loss of water appear to be the conditions favorable to the production of hypnosis and catalepsy in adult frogs. Let us remark further that, according to the researches of this author, frogs in a state of profound and prolonged hypnosis immediately awaken as soon as they are surrounded with the vapors of ether, chloroform or alcohol, which act primarily as excitants. The vapor of ammonia acts in the same way. The abrupt or progressive elevation of temperature always interrupts the state of hypnosis. On the contrary, a lowering of the temperature does not awaken frogs, and even appears to be favorable to hypnosis. The three accompanying figures show a few characteristic attitudes of frogs in the hypnotic state. Upon looking at them we cannot prevent ourselves from thinking of the attitudes of hysterical persons plunged into a hypnotic sleep. The frogs present nearly the same spasmodic positions as do those hypnotized subjects christened so picturesquely by Féré as "laboratory frogs." The difference resides in the suppleness of the attitudes, which are purely muscular and general in frogs, but more delicate and at the same time more expressive in hysterics. It is true that the animal scale embraces many types of vertebrate from the nervous frog, which also has its hysterical individuals (as De Tarchanoff has recently demonstrated), up to the noble hysteric belonging to the last round of bio-organic evolution.

We dwell upon the researches of Mlle. Stefanowska, aside from the importance of the question in itself, because we too have made some experiments upon hypnosis in frogs and especially upon the species known as *Rana temporaria*. We shall here sketch the principal facts of such researches in a brief manner, it being our intention to return to the subject in a general work on hypnosis in animals. In fact, we have experimented, and are continuing to experiment, upon dogs, cats, guinea pigs, rabbits, chickens and snakes. To our knowledge, no work has been undertaken upon so numerous varieties of animals. At present, we shall occupy ourselves with hypnosis in frogs solely.

Gley makes a correct observation in remarking that hypnosis is particularly favorable in half-starved frogs. The fact is true, and our observations agree with those of Mlle. Stefanowska. Our frogs, emaciated or fasting, were easily hypnotized, and a goodly number of them entered into a cataleptic state. Their sensitiveness was almost abolished, their pupils punctiform, and their circulation slow; and their respiration became so much the more superficial in proportion as the hypnosis became more profound, and that, too, with a crisis of internal respiration corresponding to a marked acceleration of the heart. What is new in our experiments is the hypnotizing of frogs by looking them in the eye, and aside from any fasting. We made the experiment in summer, taking care to feed the animals in an aquarium in which they were living immersed in water.