BENZINE MOTOR CYCLE.

One is apt to feel that the railway locomotive is a magazine of power, an annihilator of distance, an embodiment of energy and altogether a marvelous production which commands respect almost as if it were a thing possessed of life and intelligence. Recently a locomotive has been devised for the use of the individual, which is no less interesting than the railway locomotive. It combines the peculiarities of the bicycle and the locomotive, and forms a new species of machine known as the motor cycle.

The particular machine which we illustrate was made in Munich, Bavaria. It was used in Germany by Mr. Henry Hirsch, of the SCIENTIFIC AMERICAN corps, and was by him brought to this country. It has been run over the ample floors of this office, much to the interest and amusement of the employes and visitors who chanced to be present at the time.

We have made an elaborate set of illustrations on account of the novelty of the machine, as well as the interest attached to the motor, aside from its connection with the bicycle.

In Fig. 1 the machine is shown in actual use.

Fig. 2 is a side view, partly in section.

Fig. 3 is an enlarged perspective view of a portion of one of the cylinders, showing the valve motion.

Fig. 4 is a sectional view of the benzine reservoir.

Fig. 5 is a view of the igniting apparatus, with parts broken away to show the internal construction.

Fig. 6 is a detail view of one of the ignition tubes.

Fig. 7 shows the valve controller.

The frame of the machine is formed of four parallel tubes, two upon either side, connected with the main journal boxes of the rear or drive wheel, and united at their forward ends with two pairs of oblique tubes connected by cross bars at the top, and carrying the steering head, in which is received the shank of the front fork, as in an ordinary bicycle.

Between the two pairs of horizontal bars are secured two motor cylinders, formed in one casting and provided with a water jacket. The cylinders contain pistons connected by piston rods with the crank on the main shaft. The bearings of the crank pins, as well as the bearings of the main shaft, are rendered nearly frictionless by the use of balls, as in the bearings of an ordinary bicycle. The cylinders are single acting, and the cranks, which are on opposite sides of the rear wheel, are parallel, and extend in the same direction. The engines work on the four cycle principle, and are so timed as to give one effective impulse for each revolution of the drive wheel.

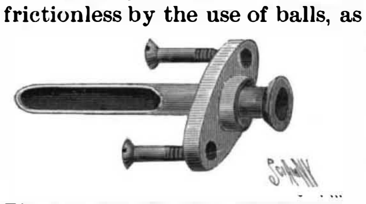


Fig. 6.—ONE OF THE IGNITING TUBES.

On the top of the cylinder, above the explosion chamber at the rear of the piston, is a valve chest containing two pairs of poppet valves, one pair to each cylinder. The valve chest is furnished with two separate chambers, one for the supply of the explosive mixture, the other for the escape of the exhaust, and the valves are held to their seats by spiral springs surrounding their stems, as shown. The valves which admit the explosive mixture are provided with light springs, so that when the pistons move forward the valves open inward automatically; but the exhaust valves are furnished with heavier springs, which hold them to their seats at all times except when they are depressed by the valve operating levers, A, A'.

These levers are made to open their respective valves in alternation by the peculiar combination of levers shown more clearly in Fig. 3. Upon the side of the rear or drive wheel is secured a cam, B, upon which presses a roller, a, carried by the arm, b, jointed to the lower side bar. A rod connected with the arm, b, is jointed to one end of the lever, C, the opposite end of which carries the hook, D. To the hook, D, is pivoted a three-armed lever, E, which is held in frictional contact with the hook by a strong spiral spring.

Pivoted to the top of the cylinders are two arms, c, c', which are pressed toward the center of the cylinder by springs. The forward projecting arm of the lever, E, is capable of bearing against the free end of one or the other of the arms, c, c'. The shorter arms of the lever, E, are alternately brought into engagement with studs, d, d', projecting from the top of the cylinders. The angled arms, A, A', are pivoted on a rod supported by ears projecting from the cylinders, and their downwardly projecting ends are engaged in alternation by the hook, D. This action of the exhaust mechanism controls the machine.

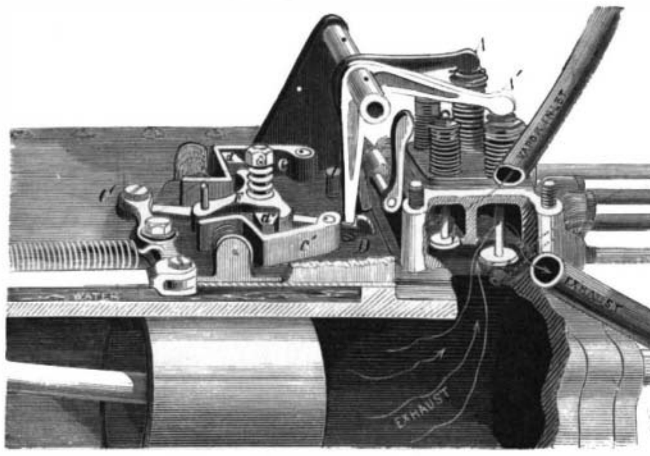


Fig. 3.—VALVE MOTION OF MOTOR CYCLE.

Fig. 4.—BENZINE RESERVOIR.

The ignition of the charge is effected by heating the nickel tubes projecting about 2½ inches from the rear ends of the cylinders into the ignition box. In this box is placed a heating vapor burner, receiving its vapor from the vertical tube at the side of the box, which contains a wick saturated with benzine supplied from the reservoir. The tubes extend into a fireclay chamber, in which are loosely placed three nickel spirals below the tubes, for distributing and retaining the heat. The heating burner, arranged in this way, effectively heats both nickel tubes, thus insuring prompt and regular explosions. The ignition tube is provided at its inner end with a flange which is clamped in place by a yoke, shown in Fig. 6. The lower oblique tube on one side of the machine conveys air to the burner, and the oblique tube on the other side serves as a chimney for carrying the products of combustion from the burner. These tubes terminate in a comparted hood, F.

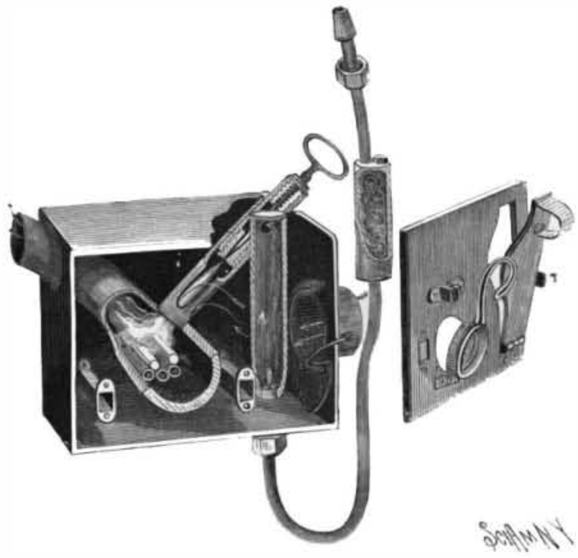


Fig. 5.-IGNITING APPARATUS.

The benzine is contained in the reservoir, G, supported by the oblique tubes at the front of the machine. This reservoir is connected directly by the small pipe, e, with the burner which heats the ignition tube. In the top of the reservoir, G, is inserted a screw-capped filling tube, f, the lower end of which is covered with wire gauze. To the top is attached a screw-capped nipple, g, through which extends a wire having on its lower end a cork float, by means of which the depth of the liquid in the reservoir is ascertained.

A conical air supply tube, h, projects into the reservoir and is provided at the top with a hood through which air enters into the reservoir. This hood is furnished with a check valve which keeps the tube closed except when a partial vacuum is formed through the action of the engine. The tube, i, projects into the reservoir and is provided with a hollow spherical lower end in which is formed a transverse slot. In this tube is inserted a wire or gauze cone connected at the top to the regulating valve, H, which latter also communicates with an air supply valve, k. The regulating valve, which is thin, is arranged to slide over the opening which communicates through the pipe, l, with the supply side of the valve casing. The proportion of benzine vapor and air conveyed to the engine depends upon the position of the valve, H, and this is regulated by the lever, m, pivoted to the handle bar and connected with the valve, H, by a rod. The lever, m, at its free end has a latch which is arranged to pass under a lug projecting from the handle bar when the valve is closed, and when the lever is released to open the valve, the regulating cone screwing on the end of the lever rests against a finger projecting from the handle bar, and serves to adjust the position of the valve by engagement with the finger as it is screwed along the threaded end of the lever.

The exhaust escaping through the exhaust valve is taken to a hood, I, made in the form of a hollow quarter cylinder, which is divided into two compartments by a perforated curved partition. The exhaust pipe enters into the smaller compartment and the larger compartment is filled with asbestos cord. The convex surface of the hood, I, is perforated. The asbestos cord serves as a muffler which deadens the noise of the exhaust.

Over the drive wheel is supported a curved water tank which is connected with the water jacket surrounding the cylinders, and the circulation of water serves to prevent the overheating of the cylinders. Strong elastic bands are connected with the connecting rod and with an arm mounted on a rock shaft at the top of the cylinder. These elastic bands may be put under tension to assist in starting by means of a screw at the top of the frame, which is operated by a crank and miter gear. The oil for the lubrication of the cylinders is contained in the upper oblique tube of the frame, and is fed to the cylinders by a sight feed, o.

To start the motor cycle, the reservoir, G, is partly filled with benzine or gasoline; the door at the back of the ignition box is opened and the burner for heating the ignition tube is started by giving it a preliminary heating by means of an alcohol torch. As the door at the rear of the ignition box is opened for this purpose, the air supply pipe is closed automatically by means of a connection with the rear door. When the tubes are red hot the valve, H, is opened, the rubber bands are put under tension and the machine is moved forward by the operator until an explosion occurs, when he mounts the machine and proceeds on his way. The proportion of the supply of air charged with petroleum vapor and pure air is regulated by the valve, H. By manipulating the cone on the lever, m, the supply of explosive mixture, and, consequently, the speed of the machine, is regulated. When the machine is fairly under way, the tension of the rubber bands is released.

The action of the machine is as follows:

The forward motion of the piston draws in the explosive mixture through the valve, H, as already described. On its return, it compresses the explosive mixture in the explosion chamber behind the piston, and a portion of the mixture is forced into the hot tube, where it is ignited, forcing the piston outwardly, giving the propelling impulse. The return stroke of the piston expels the products of combustion through the exhaust valve, which is opened by the cam, B, at the proper moment through the agency of the roller, a, and the hook, D, as already described, and the cylinders operate in alternation, thereby giving one effective impulse for each revolution of the drive wheel. To stop

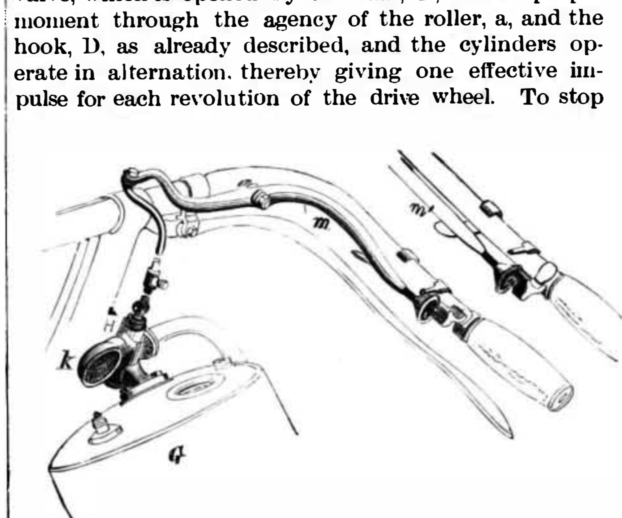


Fig. 7—VALVE CONTROLLER.

the machine, it is only necessary to close the valve, H, and apply the brake in the usual way.

The engine cylinders are $3\frac{9}{16}$ inches in diameter, with a stroke of $4\frac{5}{8}$ inches. The supply and exhaust valve apertures are $\frac{1}{2}$ inch in diameter. The benzine reservoir is 13 inches long and $7\frac{1}{2}$ inches in diameter. The driving wheel is 22 inches in diameter and the guiding wheel is 26 inches in diameter. The pneumatic tires are made specially large and heavy to support the weight of the machine and rider. The tread of the machine is 4 feet; weight when in running order, 115 pounds.

The reservoir contains a supply of benzine sufficient for a run of 12 hours. The machine is able to run at a speed of from 3 to 24 miles per hour.*

MODERN APPLICATIONS OF THE STORAGE BATTERY.

BY WILLIAM BAXTER, JR.

The storage battery came into the world with such a flourish of trumpets, and failed so completely to accomplish all that was expected of it, that for a long time it rested under a heavy cloud. The sensational press, ever ready to exaggerate the possibilities of new inventions, made claims for it that were far beyond the limits attainable, even by theoretical perfection, and those engaged in promoting its interests, either through ill advice, or an over-sanguine estimate of its capabilities, subjected it to the most trying tests, believing, no doubt, that if it succeeded in these, its future would at once be established on a firm foundation. The results of these tests, as every one knows, were disastrous, and, during the following years, those who spent their time and money in endeavors to improve upon the work of the past were looked upon as impracticable dreamers. But through the efforts of these men very decided improvements have been made, and the batteries of to-day are thoroughly practical and reliable, for a certain line of work, although they have not reached that point of perfection where they can be used with success for the purposes to which they were first applied; that is, for the propulsion of railway cars.

At the present time it is considered by those who have given the subject the most thought that storage batteries can be used advantageously in several ways; they can be used to equalize the load in lighting and power stations, to keep up the electrical pressure at the end of long transmission lines, to increase the capacity of a station, and to reduce the cost of transmission lines, by acting as transformers. To equalize the load and to increase the capacity of stations they are now used quite extensively, and are gaining a foothold in this field with remarkable rapidity. Among the larger stations where they are used for one or the other of these purposes may be mentioned: The Edison Illuminating Company, of New York City; the Hartford Electric Company (which is installing the largest plant in the world, at the present time; its capacity being nearly four thousand horse power); the Union Traction Company, of Philadelphia; the Boston, and the Lawrence, Massachusetts, Electric Illuminating Companies.

The advantages to be derived from the use of storage batteries in power and lighting stations, from an economic point of view, arise from the fact that the load upon the engines varies within very wide limits, at different times of the day, and as a consequence the average output of the plant is considerably below the full capacity. This causes a loss in two ways, one of which is through the inability to utilize the full capacity of the machinery and the other through the reduced economy of the engines, due to the fact that they must work nearly all the time at an output far below that which gives the highest efficiency.

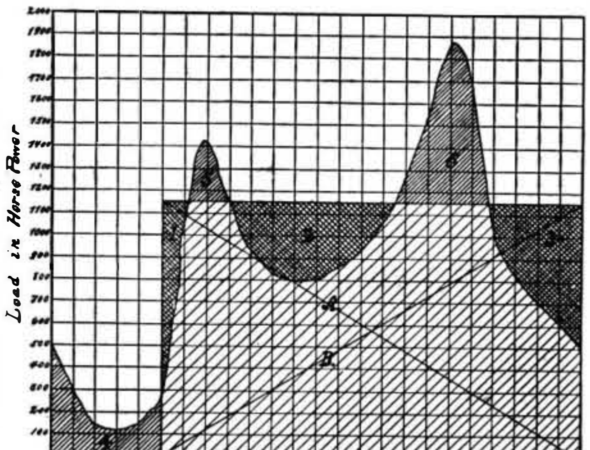
In an electric lighting station the greatest demand for power is between the hours of six and seven P.M. and the next greatest between about the same hours in the morning. During the balance of the time the consumption is much lower, and after midnight it falls off to very nearly nothing. If steam engines alone are used, their capacity must be sufficient to meet the greatest demand, even if that only lasts for a few minutes; but, if storage batteries are added to the plant, these can be depended upon to take care of the excessive demands, and then the engine capacity can be considerably reduced.

The gain that can be effected by resorting to this expedient is more clearly shown in the accompanying diagram, which represents the condition of current demand in a station which, with steam engines alone, would require a capacity of about two thousand horse power, and if provided with storage batteries, would require something less than 1,200 horse power. Starting from the left side of the diagram it will be seen that at midnight the demand is about 500 horse power, and this drops to a little over one hundred by two o'clock. At five it takes a sudden start and passes above fourteen hundred at seven o'clock, and then drops rapidly again until noon, when it is about eight hundred. From this time on until six P. M. the demand constantly increases, and reaches a maximum of nearly 1,900 horse power.

This curve would represent the average consumption of power, taking one day with another, but on special occasions the demand would be greater; therefore, at least two thousand horse power engine capacity would be required to successfully meet all demands. As can be seen from the diagram, the output for more than nine-tenths of the time would be very far below the full capacity of the engines, and, as a consequence, the efficiency would be low. The total area of the diagram represents the power the engines could furnish if worked to their full capacity, all the time, and the portion below the curve line the amount of power that is actually developed. This latter portion, it will be seen, is less than one-half of the whole; hence, the average supply, from which a revenue is obtained, is less than half the capacity of the plant.

Besides the inability to utilize the full capacity of the plant, there are two other serious objections to this arrangement. One is that, if anything goes wrong with the machinery and it becomes necessary to shut down, the lights will go out; the other is that a portion of the plant must be kept in operation at all times. To be able to accomplish this, it is customary to have reserve engines and generators, but this simply means more idle machinery.

By the use of storage batteries, the conditions can be greatly improved, as an engine capacity of about 1,150 horse power working continuously for about seventeen hours per day would furnish all the power required. The rectangle, of which A and B are the diagonals, represents this constant output, and the shaded portions of it, marked 1, 2, and 3, show the power that would be charged into the batteries, during the hours when the demand runs below the engine capacity and also the time when the charging takes place. The shaded parts, 4, 5, 6, outside of the rectangle, A, B, represent the power furnished by the batteries when the demand is greater than the engine capacity or the latter are shut down. The section 4 shows the power that is supplied while the engines are shut down and 5 and 6 the power supplied when the demand runs above the capa-



GAIN BY THE USE OF STORAGE BATTERIES.

city of the engines. As there is a loss in charging and discharging the batteries, the energy put into them must be greater than that taken out, that is, the sum of the shaded portions, 1, 2, 3, must be greater than that of 4, 5, 6; but, for all that, the arrangement is decidedly advantageous, because the capacity of the engines and electric generators can be reduced to about one-half, and the plant can be shut down for a period of from four to five hours every night, thus giving ample opportunity to make necessary repairs.

From the foregoing it will be seen that the use of storage batteries in connection with lighting and power stations is beneficial in the highest degree. Not only is the cost of operation greatly reduced, but the reliability of the service is materially increased, for if at any time it becomes necessary to stop the machinery, the batteries can keep up the supply until it is started up again, that is, if the time of the shutdown does not exceed two or three hours, and it is very seldom that anything happens that requires a stoppage of more than a few minutes. In addition to the advantages mentioned in the foregoing, if a station becomes too small to meet the demands upon it, its capacity can be nearly doubled by the installation of a battery plant, and the increase can be made still greater if the engines are shut down only two or three hours every night, instead of five, as between the hours of 1 and 5 A. M. nearly all the power could be stored.

In Europe the storage battery is used in stations to a far greater extent than here, where, until within the past year or so, it has made but little headway. Now, however, it is gaining very fast, and before long will, no doubt, be considered an indispensable adjunct in all stations.

* In SUPPLEMENT 998 is contained an illustrated description of a slightly different form of motor cycle.

THE output of petroleum in Java has been considerably increased lately, but it is expected that with an improved plant the production may still be doubled. The Dordrecht Company owning the oil wells is in a very prosperous condition, having been able to declare dividends up to 62 per cent.—Uhland's Wochenschrift.

What Can be Done with Salt.

Salt cleanses the palate and furred tongue, and a gargle of salt and water is often efficacious. A pinch of salt on the tongue, followed ten minutes afterward by a drink of cold water, often cures a sick headache. Salt hardens gums, makes teeth white and sweetens the breath. Cut flowers may be kept fresh by adding salt to the water. Weak ankles should be rubbed with solution of salt, water and alcohol. Rose colds, hay fever and kindred affections may be much relieved by using fine dry salt, like snuff. Dyspepsia, heartburn and indigestion are relieved by a cup of hot water in which a small spoonful of salt has been melted. Salt and water will sometimes revive an unconscious person when hurt, if brandy or other remedies are not at hand. Hemorrhage from tooth pulling is stopped by filling the mouth with salt and water. Weak and tired eyes are refreshed by bathing with warm water and salt. Public speakers and many noted singers use a wash of salt and water before and after using the voice, as it strengthens the organs of the throat. Salt rubbed into the scalp or occasionally added to the water in washing prevents the hair falling out. Feathers uncurled by damp weather are quickly dried by shaking over a fire in which salt has been thrown. Salt always should be eaten with nuts, and a dessert fruit salt used should be specially made.

If twenty pounds of salt and ten pounds of nitrate of ammonia be dissolved in several gallons of water and bottled, many fires may be prevented. By splashing and spraying the burning articles the fire is soon extinguished. An incombustible coating is immediately formed. Add salt to the water in which black and white cotton goods are washed. Flatirons may be made smooth if rubbed over salt. Copper and glass may be quickly cleansed by dipping half a lemon in fine salt, then rubbing it over stained objects. Lemons and salt also remove stains from the fingers. Do not use soap afterward. If a small teaspoonful of salt be added to a quart of milk it will be preserved sweet and pure for several days. A pinch of salt added to mustard prevents it souring. A smouldering or dull fire may be cleared for broiling by a handful of salt.

Salt thrown on any burning substance will stop the smoke and blaze. Bread insufficiently salted becomes acid, dry and crumbles. Bread made with salt water is said to be good in some cases of consumption. When cabbages, onions or strong smelling vegetables have been boiled in pans, to prevent odors clinging to them place some salt on the stove and turn the pans bottom up over the salt. In a few minutes the pans will smell sweet.

All salads should be soaked in salt and water to destroy animalcules or small worms. Make a strong brine, and water garden walks to kill weeds. A moderate quantity of salt stimulates their growth. Salt and camphor in cold water is an excellent disinfectant in bedrooms. Housemaids should pour salt water, after using it, down the drain pipes. Sewer gas is counteracted by a handful of salt placed in toilet room basins. Water for laying dust is more effective when salt is added. Sea water is generally used in English coast towns for this purpose.

Rattan, bamboo and basket work furniture may be thoroughly cleaned by scrubbing with brush and salt water. Japanese and plain straw matting should be washed with salt and water and rubbed dry. This keeps them soft and prevents brittle cracking where traffic is heavier. Brooms soaked in hot salt water wear better and do not break. Bedroom floors may be kept cool and very fresh in summer if wiped daily with a cloth wrung out of strong salt water. All microbes, moths and pests are thus destroyed. Black spots on dishes and discolorations on teacups are removed by damp salt.—Philadelphia Ledger.

The Lead Tree.

The difference in the strength of the affinity existing between different substances may be easily illustrated by the following experiment: Dissolve an ounce of acetate of lead (" sugar of lead ") in a quart of water and fill a glass jar with the solution. If a piece of zinc (or a few spirals of the same metal) be now suspended in the liquid, it will, after a short time, become covered with a gray coating, from which brilliant metallic spangles will shoot forth somewhat in the shape of a tree. These are pure lead, and the phenomenon is familiarly known as the " lead tree." The effect thus produced is due to the superior affinity of the zinc for the acetic acid conbined with the lead, and which causes the two metals to interchange places—the zinc combining with the acid and entering into solution and the lead being deposited in the metallic state in place of the zinc. If the action be kept up long enough, every particle of lead may in this way be withdrawn from the liquid.

This pleasing experiment is greatly dependent upon electro-chemical action. The first portions of the lead form with the zinc a voltaic arrangement of sufficient power to dissolve the salt. Under the peculiar circumstances in which the latter is placed, the metal is precipitated upon the negative portion (the lead), while the oxygen and acid are taken up by the zinc.