THE GYROSCOPE.

(*Continued from first page.*)

While this phenomenon can be perfectly shown only by means of an instrument in which the power is practically constant and the velocity uniform, the tendency of the gyroscope to act in this way may be exhibited by means of an ordinary one revolving at a high velocity. The difficulty of securing a high speed in a large gyroscope has led to the application of a friction driving device, as shown in Figs. 1 and 2, by means of which an initial velocity of from 4,500 to 5,000 revolutions per minute may readily be attained.

The instrument, after being set in motion, behaves like other gyroscopes not provided with means for maintaining the rotary motion of the wheel, but the size of the instrument and the facility with which it may be operated render it very satisfactory.

The gyroscope wheel is 6 inches in diameter, ⅝ inch thick, and, together with its shaft, weighs 3½ pounds. The annular frame weighs 1¾ pounds. So that 5¼ pounds must be sustained by gyroscopic action when the counterbalance is not applied.

The driving wheel is 7¾ inches in diameter. Its face is ¾ inch wide. Its shaft is journaled in an arm pivoted to the base, with its free end adapted to enter a recess in the edge of the annular frame, for supporting the gyroscopic wheel while motion is being imparted to it. Upon the shaft of the gyroscope wheel is secured a soft rubber tube having an external diameter of nine-sixteenths inch. This shaft makes 13·84 revolutions to one turn of the drive wheel, so that when the drive wheel is turned six times per second the gyroscope wheel will make very nearly 5,000 turns per minute (4,982).

This gyroscope may be arranged as a Bohnenberger apparatus by removing the tall standard and attaching the shorter one to the center of the base by means of a bolt. The annular frame of the instrument is suspended on pivotal screws in the extremities of the semicircular support, which is capable of turning on the upper end of the short standard. In the engraving the short standard, together with the semicircular support, is shown lying on the table. The usual counterbalance is also shown lying on the table. Fig. 1 shows the drive wheel in position for imparting motion to the gyroscopic wheel, and Fig. 2 shows the driving wheel withdrawn and the gyroscope in action.

As this instrument does not differ from the ordinary one, except in the application of the driving mechanism, it will be unnecessary to go into particulars regarding its performance.

In Figs. 3, 4, and 5 are shown pneumatic gyroscopes, and Fig. 6 represents a steam gyroscope.

The pneumatic gyroscope shown in Fig. 3 consists of a heavy wheel provided with flat arms arranged diagonally, like the vanes of a windmill. The wheel is pivoted on delicate points in an annular frame having an arm pivoted in a fork at the top of the vertical support. The arm of the annular frame carries a tube, which terminates near the vanes of the wheel in an air nozzle which is directed toward the vanes at the proper angle for securing the highest velocity. The opposite end of the tube is prolonged beyond the pivot of the frame.

The support of the annular frame, shown in vertical section in Fig. 4, consists of an inner and outer tube, the inner tube having a closed upper end terminating in a pivotal point. The lower end of this tube communicates with the horizontal tube, through which air is supplied to the machine.

A sleeve, closed at its upper end and carrying the fork in which the arm of the annular frame is pivoted, is inserted in the space between the inner and outer tubes, and turns on the pointed end of the inner tube. The inner tube is perforated near its pointed end, to permit of the escape of air to the interior of the sleeve, and the lower end of the sleeve is sealed by a quantity of mercury contained by the space between the inner and outer tubes. The air pipe carried by the annular frame communicates with the upper end of the sleeve by a flexible tube. When air under pressure passes through the inner pointed tube, through the sleeve, and through the air nozzle, and is projected against the vanes of the wheel, the wheel rotates with great rapidity, and the gyroscope behaves in all respects like the electrical gyroscope above referred to.

The gyroscope shown in Fig. 5 is adapted to the standard just described, but the heavy wheel is replaced by a very light paper ball, whose rotation is maintained by two tangential air jets, which play upon it on diametrically opposite sides, and nearly oppose each other, so far as their action on the surrounding air is concerned. The rotary motion is produced solely by the friction of the air on the surface of the ball. The upwardly turned nozzle is arranged to deliver an air blast which is a little stronger than that of the lower nozzle, so that a slight reactionary force is secured, which assists the gyroscope in its movement around the vertical pivot sufficiently to cause the ball to maintain its horizontal plane of rotation continuously. In fact, this gyroscope will start from the position of rest, raise itself in a spiral course into a horizontal plane, and afterward continue to rotate in the same plane so long as air under pressure is supplied.

It may be questioned whether this machine is a true gyroscope. However this may be, it is certain that the reactionary power of the stronger air jet is of itself insufficient to produce the motion about the vertical pivot; neither is there a sufficient vacuum at the top of the ball to produce any appreciable lifting effect.

The steam gyroscope shown in Fig. 6 hardly needs explanation. It differs from all of the others in generating its own power within its moving parts. The boiler is supported by trunnions resting in a fork arranged to turn on a fine vertical pivot. The engine is attached to the boiler, so that both engine and boiler swing on the trunnions in a vertical plane. The wheel of the engine is made disproportionately large and heavy, to secure the best gyroscopic action.

The performance of the steam gyroscope, is like that of the other power-propelled gyroscopes, and needs only a reactionary jet of steam or some other slight force to keep up the rotation around the vertical pivot, and thus render the action of the instrument continuous.

It has been suggested that, as the engine makes from 1,000 to 2,000 revolutions per minute, the exhaust steam might be turned to account in producing the reactionary effect necessary to maintain the action continuously.

A NOVEL FLOWER POT.

The flower pot shown in the accompanying engraving is the invention of Mrs. S. L. Hunter, of Little Rock, Ark. The pot is made with two walls forming a space between them that serves as a water reservoir. In the inner wall near the bottom are holes through which the water flows to moisten the earth. Fixed to the side of the outer wall, and communicating with the reservoir by a hole, is a spout through which the reservoir may be filled or emptied as required. By thus admitting the supply of water at the bottom, the plants are made to send down deep roots in the earth to seek the moisture, and they will not be so liable to send out roots near the surface, as in the case of pots supplied by pouring water on top of the packed and hardened earth. Plants set in these pots may be transported a long distance, as the reservoir holds water sufficient for many days.

A Mighty Petroleum Fountain.

Mr. Charles Marvin, writing to the *Pall Mall Gazette*, says:

The Russian newspapers just received contain a telegram from Baku announcing the greatest outburst of oil ever known. It runs thus: "Baku, October 5.—At Tagieff's wells a fountain has commenced playing at the rate of 30,000 poods of petroleum an hour. Its height is 224 ft. In spite of its being five versts from the town, the petroleum sand is pouring upon the buildings and streets." It is astonishing that the St. Petersburg correspondents of the London papers should not have telegraphed this remarkable phenomenon, and I can only account for their remissness on the grounds that they have either been too preoccupied with Bulgarian matters or have grown so accustomed to fresh oil fountains at Baku lately as to be blunted to the significance of the present one. Yet Tagieff's "gusher" beats out and out every previous record in the oil regions of the two hemispheres. The champion petroleum fountain up to now has been the "Droojba," which in 1883 spouted to the height of 200 ft. or 300 ft., at the rate of nearly 3,300 tons of oil a day. "This single well," I wrote from the spot in that year, "is spouting more oil than all the 25,000 wells in America yield together."

Such an outflow was looked upon as almost incredible, and had there not been other Englishmen at Baku at the time, I should have probably fared as badly as Bruce and other travelers. But the Droojba is now nowhere. Tagieff's well is spouting nearly 500 tons an hour, or more than 11,000 tons of oil a day. If it were in London, it would top the Monument by 20 ft., and the mansions of far off Belgravia would be covered with its greasy dust. During the birth throes of a Baku oil fountain, stones are hurled a terrific distance, and a high wind will carry the fine sand spouting up with the oil miles away. The roar of the gas preceding the oil flow is terrific, and the atmosphere for a time is rendered almost unbearable. Compared with such fountains as the Droojba and Tagieff, the Great Geyser of Iceland is a pygmy. Luckily the gas soon clears off, the stones cease to rattle about the surrounding buildings, and then the fountain becomes as orderly as those in Trafalgar Square, pouring upward sky high with a prodigious roar, and forming round about the 13 in. or 14 in. orifice vast shoals of sand, beyond which the petroleum gathers in lakes large enough sometimes to sail a yacht in.

How long Tagieff's "spouter" will last, and what its ultimate yield will be, will depend upon circumstances. The Droojba lasted 115 days, flowing for 43 days at the average rate of nearly 3,400 tons a day, 31 days at 1,600 tons, 30 days at about 900 tons, and 11 days at 600 tons. The owners then managed to fix a "cap" over the orifice, and placed the well under control. The total amount of oil spouted, at the very lowest estimate, was 220,000 tons, or 55,000,000 gallons; the highest estimate put it at 500,000 tons. At a rough estimate, had the oil spouted in America, it would have realized about a million sterling, and made its owner a millionaire, instead of which the fate of the fountain at Baku was to render its master a bankrupt; for the shoals of sand engulfing neighboring buildings led to claims of damage surpassing what he got for the small quantity of oil he was able to catch and store, while the rest, flowing beyond on to other people's property, was in most cases "annexed" and not paid for. It is to be hoped that Tagieff & Co. will not be so unlucky; but in any case most of it is sure to be wasted.

Lechesne.

"Lechesne" is an alloy of nickel, copper, and aluminum for the production of a superior kind of *maillechort*, or German silver. It is recommended as combining absolute malleability with an exceptional degree of homogeneity, tenacity, and ductility. The inventor, M. Thirion, claims also for the new metal less liability to oxidize and to act as a heat conductor than other alloys heretofore in use. These latter advantages, he holds, are conspicuous on a comparison of the new alloy with those of nickel and copper for coinage, and with the old fashioned descriptions of German silver (nickel, copper, and zinc), or, again, with the best kind of latten. Like gold, silver, and platina, the "lechesne" alloy satisfies the conditions of the most difficult processes that could be applied, such as hammering, drawing, and deep chasing or punching, especially in ornamental work. The distinctive feature of this metal consists in the addition to the binary alloy (nickel and copper) of a quantity of aluminum, calculated according to the proportion of the nickel. The aluminum is introduced a few moments before the casting process, care being taken to send it to the bottom of the fusion, and to insure thorough distribution throughout the mass by vigorous mixing. Its combination is facilitated by its natural affinity to both copper and nickel. The proportion of the aluminum entering into the alloy is as follows: One gramme 65 centigrammes per kilo of alloy containing 10 per cent of nickel. Any attempt to deoxidize an alloy of nickel and copper in which the aluminum was not carefully introduced toward the close of the fusion would lead to carbureting. If it were sought, for instance, to expel the surplus carbon by superheating, the inadequate quantity of free oxygen present would prevent the combustion of the carbon, so that the metal would in reality become even more deteriorated by the process by an increased oxidization. The aluminum both deoxidizes and decarburets the metal, but the following precautions should be observed: The nickel is first placed in the crucible, and as soon as it melts, the copper is gradually introduced, the vessel, of course, being closed. When the two metals are in a state of fusion, they are puddled together. Then the alloy is reheated and the aluminum thrown in, the temperature being rapidly raised almost to boiling point. In the next place the alloy is cast very hot, this operation being effected promptly and with the utmost regularity. The chief malleableness of the article is derived from the copper, which imparts a property and a tone in that respect found lacking in the nickel. The aluminum suddenly, but surely, oxidizes the alloy, burning away every trace of the carbon introduced into the crucible by the raw material; it considerably augments the tenacity of the alloy, and, above all, insures its compaction. The new metal is regarded in industrial circles as likely to effect considerable changes in many branches of trade, and has already been experimentally tested, with the most gratifying results.

Piston Valves for Locomotives.

According to M. Ricour, piston valves in locomotives wear at the rate of one twenty-fifth inch for 125,000 miles, while with the slide valve the same extent of wear takes place with one-sixtieth of the mileage. The wear of the valve gear is reduced in the same proportion. The effect in the consumption of fuel is shown by the returns made at Saintes Station for the year 1882, where on all engines worked with slide valves the coal consumed per 1,000 tons conveyed one mile was 226 lb., against 234 lb. in the year 1884, when 30 out of 40 locomotives had been fitted with cylindrical valves.