an inch in length, but I had a pair given me in Texas which measured nearly two inches.

The venom is a thin, clear fluid, resembling serum, of a slightly bluish cast in some specimens and yellowish in others. Its specific gravity is slightly greater than water, in which it is freely soluble. Placed in alcohol, a portion dissolves, and is harmless. The rest coagulates in stringy masses like albumen, and is the poisonous element. Heat coagulates the entire mass easily, and a slightly musky and disagreeable odor is emitted. The venom contains saline matter and phosphates, forming groups of crystals under the microscope, which also detects globules of fatty matter. Acetic acid dissolves it, and keeps its properties unimpaired for years. I accumulated quite a quantity of the venom some years ago, and tried a number of experiments to determine its physiological and chemical properties. It was neutral with both litmus and turmeric. Placed in contact with fresh blood, however, it became rapidly acid, emitted a musky odor, and coagulated fibrin rapidly. It also acted as a putrefacient. I divided a fresh liver, and injected a drop of rattlesnake venom in one half. Exposed under similar conditions, this piece was putrid in a few hours, while the other was untainted for over a day. These two actions give a hint of its deadly quality. First, it acts as an irritant; secondly, coagulating the fibrin and choking up the capillaries, it will produce local thrombosis and act as a mechanical poison; and, thirdly, by its putrefacient effect induce general pyæmia or gangrene in the wounded limb. Thus, also, it can be seen why alcohol is indicated. By stimulating the heart, the blood will flow too rapidly to coagulate, or those filaments of fibrin partially formed will be forced through into larger channels, where they may be redissolved, and the tendency to putrefaction will also be neutralized and checked. The danger from irritation alone is comparatively slight, but even this is lessened by the stimulant.

I rusted several needles with nitric acid, and then gave them a coat of venom, to try some experiments with animals. A mouse, on being punctured in the leg, died in less than a minute, there being but one spasmodic convulsion. Rabbits, a few seconds after the wound was given, gave one wild leap and fell struggling, death ensuing in three or four minutes, the breathing being labored and irregular, as though by paralysis of the pneumogastric nerve. I buried an abundantly coated needle in the thigh of a cur. He emitted a little yelp of surprise, then trotted off unconcerned. Suddenly he stopped, as though he had forgotten something, then tried to proceed, but his hind quarters sagged and refused to move. I approached. His eyes were bloodshot, fixed, and staring, hair erect, lips retracted, and tongue protruding. His respiration was labored and irregular, and he emitted a cry that was half moan, half howl, as with mingled pain and terror. Suddenly he went into a convulsion, which recurred at short intervals for twelve minutes, when he died. Cats behaved more violently, frothing at the mouth and giving vent to terrible cries, death not coming to their relief for thirty minutes or more.

On frogs the effect was electric; the luckless batrachians simply stretched out, quivered, and yielded up the ghost. A goldfish turned belly up in four minutes, and in eleven minutes was dead. A rattlesnake was dosed, and after eight minutes of active contortions gave but feeble signs of life for one hour and ten minutes, and then was still. Post mortem examination showed an anæmic condition of the brain and an engorgement of the ventricle with dark clots, but no other signs. Applying the stethoscope to a dog strapped down and punctured, I found the action of the heart to be at first violent, but regular, and then irregular and weak. Four drops, administered to a dog internally, seemed to have a marked sedative effect, but the symptom soon passed away. I was encouraged by this into taking one drop myself, diluted largely with water and taken through a tube. I fancied there was a slight increase and irregularity of heart action, and certainly muscular relaxation sufficient to produce a marked perspiration, but the effect was temporary. If this experiment should be repeated, I would caution the experimenter to be sure he has no abrasion on lip, tongue, or palate, and that his teeth and gums are sound, or he may have to record symptoms not in the above catalogue of my experience.

I concur in the belief that, admitted to the circulation, rattlesnake virus paralyzes the heart, but I believe the effect is first rather cerebral than directly cardiac. I have no doubt embolism occurs in many cases where the poison has reached a large vein and is carried directly to the heart, exercising its coagulant power there; but this is the exception, and not the rule. At all events, ammonia is indicated, and, in conjunction with a liberal use of alcohol, I believe it to be the best remedy which can be applied. To lance the wound promptly, after tightly binding the injured limb above the wound, would be efficacious in lessening the danger; but in any case whisky and ammonia in small doses, frequently repeated, will be a necessary resort.

I have seen the Apaches on the Tulerosa Reservation, in New Mexico, take a deer's liver, induce a rattlesnake to strike it repeatedly, allow it to get putrid, and then smear their arrow heads with it, but unless freshly used the virus so applied would have no effect. Exposed to air, it quickly loses its properties, particularly when in contact with serum or fibrin.

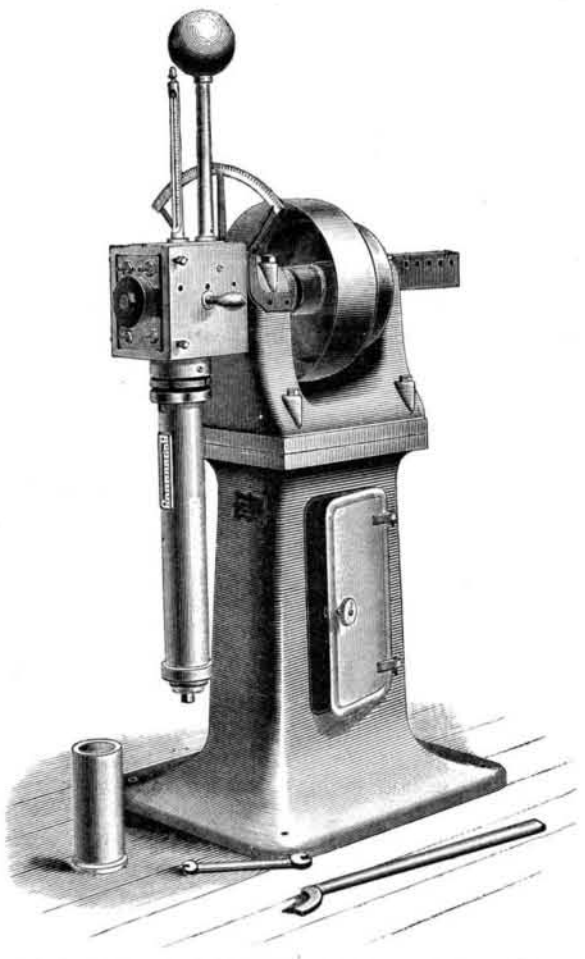
In quantity, the venom injected by a large and active rattlesnake is about four minims, or two for each fang. He can strike twice or thrice in rapid succession with deadly effect, but soon the glands are unable to keep up the supply, and he will require some minutes to recuperate. Snake charmers usually sear the glands with a hot iron, leaving the fangs intact, but only capable of making a slight flesh wound. Too much care cannot be exercised in dissecting a rattlesnake's head, for the glands secrete for some time after death, and a little of the virus goes a long way.

During the hot days of August and September, the rattlesnake is indolent and very ill tempered. This is the season when they are supposed to be blind, but it is laziness, and not ophthalmia, which induces them to wait till they are trodden upon before moving. This is also the time when they lie in the grass near streams to avoid the heat and waylay the frolicsome frog. I suppose trout fishermen know this, for I notice they always carry a bottle of antidote.

In New Mexico and on the Staked Plains in Texas, where the nights are cool, it is the rattlesnake's sociable custom to crawl between a traveler's blankets and snuggle close to him till morning. Numbers of them are killed in camp every year by soldiers campaigning in that section; but as the rattlesnakes never abuse hospitality by biting the sleeper, few accidents happen. Still, there are men who, when out on a hard march, prefer to sleep alone.

THURSTON'S STANDARD RAILROAD OIL TESTING MACHINE.

This machine has been specially designed to provide means for reliable and systematic investigation of



THURSTON'S STANDARD RAILROAD OIL TESTING MACHINE.

the value of the various lubricating oils used in railway service, and for all purposes for which it is essential to reduce to a minimum the friction of bearing surfaces under heavy pressures; securing economy in power required, and determining the best, and consequently the *cheapest*, oils for lubricating purposes.

Additional advantages secured in this machine are those due to rigidity and careful fitting of the separate parts, while the whole machine is arranged with special reference to convenience of operation.

The journal, which is Master Car Builders' standard, 3¾ inches diameter, is a hardened steel sleeve, ground perfectly cylindrical.

The boxes in which this journal runs are of phosphor bronze, and are designed for internal water circulation.

A late improvement includes a thin lining of phosphor bronze or other metal ordinarily used, which can be accurately weighed before and after a test, thus determining the percentage of wear for any given metal and mileage. The linings are made perfectly interchangeable, and can be renewed at any time, or special linings of any other metal or alloy may be inserted, using the same water brasses.

Pressures up to 9,000 pounds are obtained by the use of a heavy helical spring secured within a 4 inch wrought iron pendulum tube. By a convenient taper key adjustment (not shown in the cut), the pressure may be easily and quickly relieved for removal of the pendulum and brasses, for inspection of the latter or of the journal, without release of pressure of the spring by the ordinary means, the latter being, obviously, a tedious operation.

The standard water brasses may be replaced by the ordinary brasses used in freight or passenger service, if desired, giving actual conditions, in this respect, under which the test may be conducted.

Friction at the surface of the journal is indicated on a graduated arc, conveniently placed above the pendulum.

The tendency of friction between the surfaces of the journal and brasses is to rotate the heavy pendulum; hence to give as great a range as possible, and thus render this function an important adjunct, and also to enable the observer to note small variations of resistance, a form of compound pendulum is adopted, as shown in the illustration.

A standard thermometer, graduated 40° to 350° Fah., and Centigrade to correspond, is inserted to indicate, as nearly as possible, the exact temperature of the surfaces in contact. A positive automatic revolution counter is attached, registering up to 1,000,000, affording ready means for determining the comparative mileage run during any investigation.

Speeds corresponding to rates usual for train service, either freight or passenger, are obtained by the use of a countershaft having two pairs of tight and loose pulleys, 10 inches diameter, 6¼ inches face, and 18 inches diameter, 4⅝ inches face, respectively. A two grade cone, 4¼ inches face, gives ample belt efficiency for the four speeds thus obtained. The countershaft should run 150 and 430 revolutions per minute.

An extra journal sleeve of wrought axle iron, wrenches, and countershaft complete, furnished with each machine.

As a valuable office hand-book covering this important subject, we would refer to Professor R. H. Thurston's "Friction and Lost Work in Millwork and Machinery," published by John Wiley & Sons, New York.

This improved testing machine for lubricants is now built by the Pratt & Whitney Company, of Hartford, Conn.

The Metzdorff Pianoforte Improvements.

For many years, pianoforte manufacturers have experimented in the construction of instruments which will mechanically facilitate the transposing of music, so that any given piece may be conveniently played in any desired key, while the player would still use the same keyboard. Such devices heretofore have not been sufficiently perfected, consequently have never obtained wide recognition, although musicians and instrument makers are well aware of the importance and value of a good practical invention of this character. The difficulties hitherto experienced are obviated, it is claimed, by a recent invention of Mr. Louis Metzdorff, of Concepcion, Chili, who has made use of the left pedal, as now found in the pianos of some of our best manufacturers, to raise the hammers and other parts of the action, so as to leave the keys in a vacant space beneath, and permit the lateral adjustment of the keyboard as required. The keyboard is also lengthened for additional keys, and it is so devised that these additional keys are moved under or out from the hollow side parts of the piano case by laterally moving the keyboard in either direction, to the extent of a whole octave, either up or down the scale.

The application of this invention to the instrument does not interfere with or impair the usefulness of any of the many other modern improvements which have imparted to the piano its extraordinary and comprehensive power as an interpreter of musical ideas. The Metzdorff improvements aim to widen the sphere of usefulness of this noble instrument, by adapting it to any varied degrees of musical culture, so that compositions may be more widely brought within the scope of singers whose voices may not cover the scale in which a score had been originally written. It also applies with equal advantage to accompanying other instruments, such as the violin, flute, etc., by adapting itself to their pitch.

Mr. Metzdorff has obtained a patent on this improvement in the United States and several other countries, and now aims to arrange for its general introduction. Further particulars can be obtained by communicating with Messrs. J. Parker Read & Co., *Tribune* Building, New York, who have for exhibit a piano with this invention applied.

Error in the Balance.

A current of air may be produced if an evaporating fluid in a beaker is placed upon one scale. The error may amount to 0·4 mg. A source of error, less common, but sometimes more serious, is electric action produced by friction of the balance case and consequent attraction of one scale pan. T. E. Thorpe (*Journal Chem. Soc.*) calls attention to small daily fluctuations of the zero point.—*R. Hennig.*