

from thirty to forty tons, and there have been instances in which a concentrating table has satisfactorily handled as much as fifty tons in twenty-four hours. The amount of water required for the operation of a machine ranges from five to twenty gallons per minute. The concentrators utilized by the government in its present experiments are operated by individual electric motors of from one-half to two horse-power each.

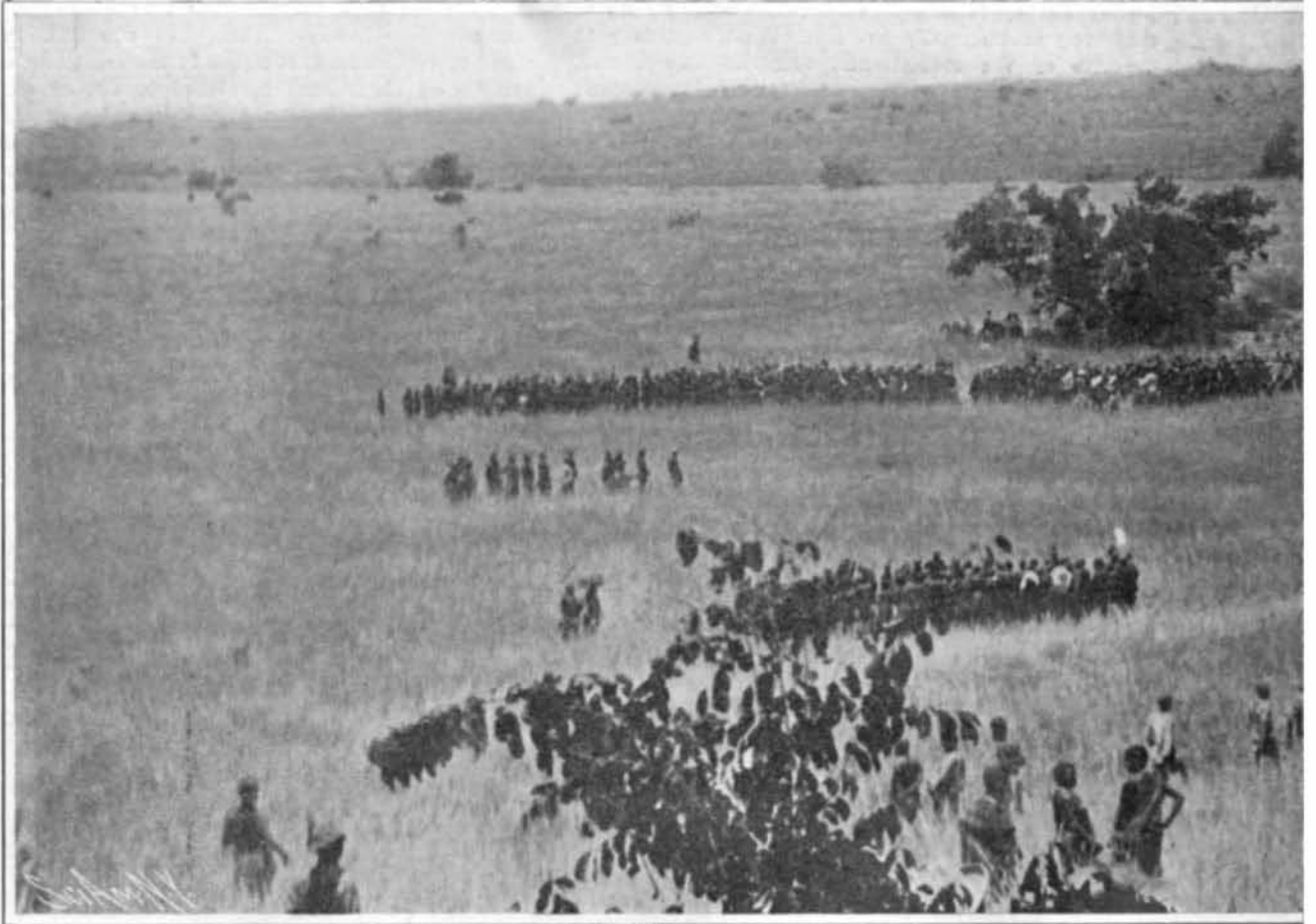
THE FIGHTING TRIBES OF SOUTHERN AFRICA.

Scattered through her vast territories, Great Britain numbers among the subjugated races hundreds of peoples which even to-day are savage, turbulent, and restless, ever seeking opportunities to rise and throw off the yoke with which the white man has burdened them. Rare, indeed, is the time that some English force is not somewhere engaged in a repressive or punitive expedition, or in restoring order in rebellious territories. For a number of years past the blacks of South Africa have been comparatively quiescent; the white troopers and native rangers in the pay of the government have done their work thoroughly. Particularly is this true in the native states near the earlier white settlements, or of those tribes which dispute the right of way with the Boers. England's policy with regard to the natives, and not of South Africa alone, has often been one of the crassest ignorance and misgovernment, and one moreover which frequently resulted in those terrible uprisings and colonial wars which have blotted the history of many of her fairest dependencies. And while the white man has, of course, been victorious in the end, the cost has sometimes staggered humanity. The policy of the British government in South Africa to-day bids fair to arouse the still savage black population to united revolt, and reports from disaffected districts indicate that the disturbances are of greater extent than is generally realized.

The act which has been the ultimate cause of the present rebellion of the negroes is known as the "Glen

under the chief Bambata is directly due to the head tax; it followed the killing of two English collectors by Zulus, with the subsequent execution by the gov-

ernment of twelve natives implicated in the murders. Whether there is sufficient cohesion between the various tribes to make possible a general rebellion is prob-



Kafirs Assembled



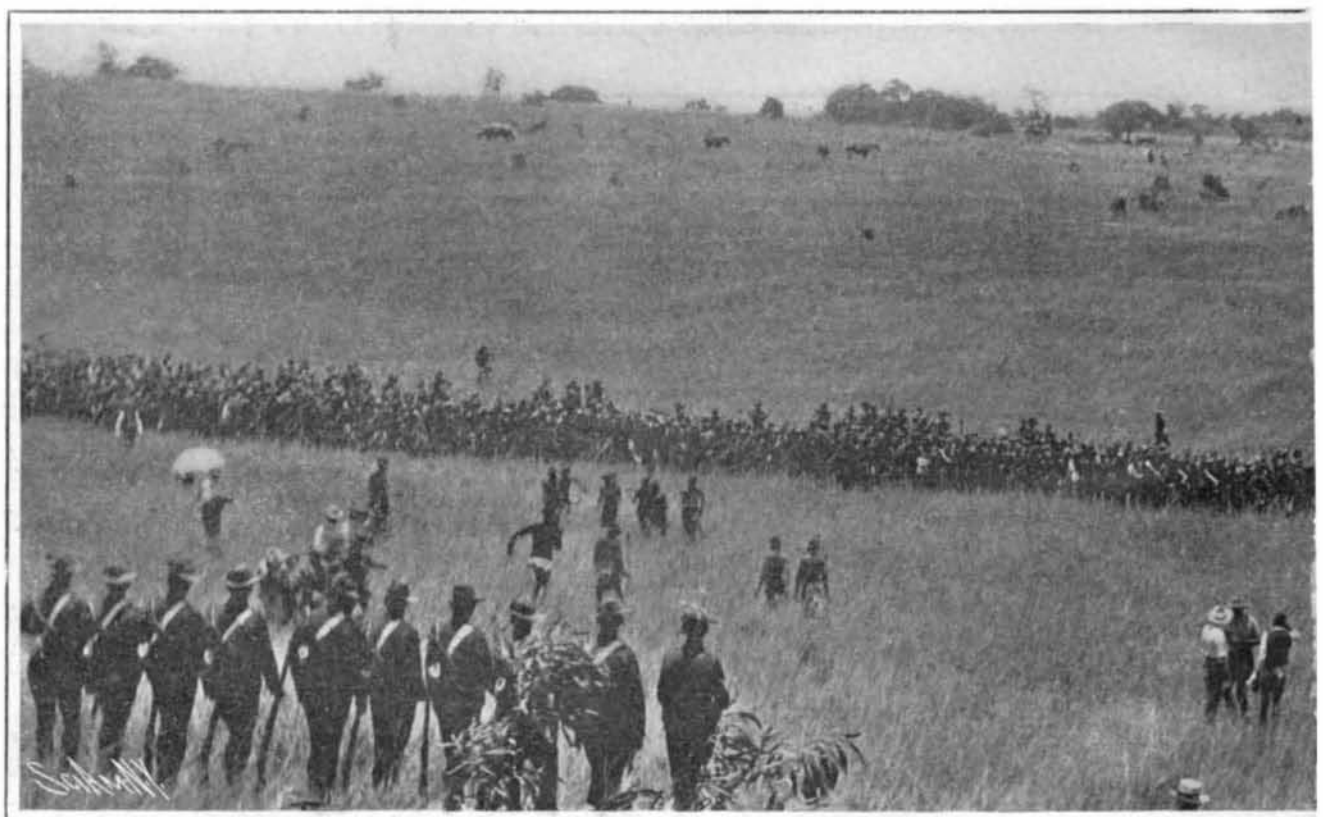
A Zulu War Party Ready for the Trail.



Kafirs Traversing a Trail

Grey Act" of Cape Colony, and its real author was that master mind of South Africa, the late Cecil Rhodes. This law, which to-day exists also in Natal, Orange River Colony, and the Transvaal, provides that every native must pay a yearly head tax, and in default be imprisoned for a certain period, or work off the tax and attendant fine in the employ of some white man. The last clause explains the true significance of the law and the reason for its enactment—the labor problem. While the earlier differences between the natives and the settlers were due to territorial and governmental disputes, for the last twenty years these questions have fallen into the background before the problem of native labor. The year 1886 saw the beginning of the great mining industries with the discovery of gold on the Witwatersrand—industries which, of necessity, require the employment of many thousands of laborers. Because of the small number of the whites, and for climatic reasons, the laborers were to be found only in the ranks of the native blacks. Now, the native is constitutionally and ethnologically averse to protracted labor. He will work in fits and starts at that period of the year which is climatically unsuited to his tentative agricultural pursuits, or his care-free loafing—in other words, the winter. Even the head-tax scheme, however, failed substantially to improve the labor market, and as the subsequent importation of coolie workers into South Africa has not been very successful, the labor problem is still no nearer solution.

One thing is certain, the natives resist the imposition of the tax in every possible manner—by trickery, by evasion, and finally by force. The present uprising



A Great Kafir War Dance
THE FIGHTING TRIBES

lematical, but the revolt is unquestionably spreading, and already one British force has suffered a reverse. The blacks of South Africa, the Kafirs, must be con-

sidered among the sturdiest of savage fighters; especially is this true of such tribes as the Zulus and Matabele. Whether their fighting ability is still such

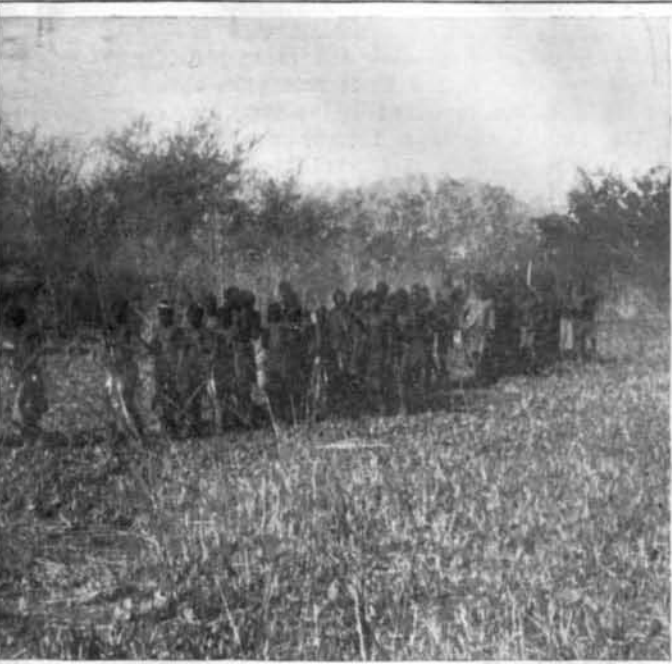
as seriously to menace the white man's superiority, even temporarily, remains to be seen.

The South African native, exclusive of the Hottentot or Bushman, must be counted among the highest of the blacks. Certain of his characteristics are admirable; he is brave to a fault, and a most consistent enemy, while capable of fidelity and gratitude. Where contact with the white race has not corrupted him, he is fairly honest, though, it must be admitted, lazy and improvident. By nature he is a savage, and as such he wages savage war, often with a brutality and bloodthirstiness which seems incomprehensible to us—who prefer to kill at half a mile with a leaden pellet, rather than with a three-foot spear blade at half a yard. Dispossessed of his lands by force, ever driven backward by British, Boer, or Afrikaner, the prey of a civilization which he can neither understand nor acquire, it is little wonder that the black has at times resisted primitively, fiercely, and desperately. His is the story of the Indian, of the Polynesian, of the savage the world over, a pitiful story that is as unchangeable as history itself, and that can have but one ending, the absolute supremacy of the white race. Whether or not this means the destruction, the absorption, or the independence of the native is a question for future generations to solve.

The Kafirs are ethnologically cattle breeders, though their agriculture includes the raising of various vegetables and fruits. They eat meat only when fighting, and the cattle are used largely as a medium of exchange. Their houses are cone-shaped and are grouped in kraals. The male is essentially a warrior; the woman, the farmer and the general drudge. The Kafir's life-long feuds with his enemies, native and white, have developed in him mental and physical qualities far above those of the true negro. He is tall, slim, and muscular and capable of great physical exertion. His native weapons are the knob-kerry, or striking and throwing club, and assegais, or spears for hurling or thrusting; he protects himself with a great



ing for the War Dance.



through the South African Bush.



A Nearer View of the War Dance.



on the South African Veldt.

ES OF SOUTHERN AFRICA.

decorated shield of toughened ox-hide. The original religious beliefs of the Kafirs are on a much higher plane than those of most other African tribes; the type of religion was an advanced grade of ancestor worship. The government of the tribes is an absolute chieftaincy, with an hereditary sovereign or *Inkose*.

The great Kafir tribes, which doubtless arose out of the original Hottentot-Bushmen, belong to the Bantu family, inhabiting the eastern and coastal regions of the southeast part of the continent. The name Kafir is generic, and applies to almost all the blacks inhabiting South Africa, so called, and includes to-day the Zulus, Matabeles, Basutos, Bechuanas, Swazies, Pondoes, and Fingoes, with several lesser tribes. At the period when the early settler began to penetrate from the coast, the Kafirs included over a thousand distinct tribes, but continued wars with one another and with the whites have so materially reduced these tribes by extermination and consolidation, that but a handful remains to-day. The first Kafir war with the settlers began about 1785, arising from a boundary dispute between the Zulus and the Dutch. Since that time the clashes with the white settlers have been numerous, sometimes mere spontaneous and scattered uprisings, and at other times bloody and protracted wars, such as those with the Zulus and Matabele. Nor have the white men been always undefeated, as evidenced by the terrible battle of Isandula, where a British column was overwhelmed and destroyed by 20,000 of the splendidly-trained warriors of Cetywayo, the greatest of the Zulu kings. The Zulus are easily the best of the Kafir races, and have always offered the sturdiest resistance to the whites. Their intelligence is well above

the average; they are fairly moral, and in the native state temperate in all things. The desperate courage and fighting ability of the Zulus is historic throughout South Africa.

Notwithstanding the reduction in numbers which the Kafirs have suffered during the last generations, they are still numerically strong enough seriously to menace the white race. It is estimated that the natives of Cape Colony number about 1,350,000; of Basutoland, 300,000; Natal, 400,000; Zululand, 150,000; Amatongaland, 25,000; Bechuanaland, 50,000; Orange River Colony, 125,000; Transvaal and Swaziland, 700,000; Rhodesia, 1,500,000; and Nyassaland and neighboring territories, 1,100,000; while the total whites in the colonies number but 1,250,000. The safety of the settlers doubtless lies therein that the Kafirs are disintegrated and lack tribal cohesion. Were it not for this, a concentrated uprising might sweep the entire white population into the sea, necessitating the final crushing of the blacks by superior weight and armament, and with the subsequent recommencement of the entire work of colonization. It is to be hoped that the present sporadic uprising will be suppressed at once, either by overwhelming force, or, preferably, by conciliatory measures; for a savage native war, aside from the horrible barbarities which usually are incident to it, would seriously menace the present increasing prosperity and development of the South African colonies.

Results of an Experiment with the Vuia Aeroplane.

The Vuia aeroplane, which was illustrated in our issue of March 24 last, was subsequently experimented with by its inventor at Montesson, in France, and the results were more or less satisfactory. In describing the action of the machine, M. Vuia says that one of the first things he noticed when it was under way was that each time the forward springs of the running gear expanded owing to the lift, the speed increased and he did not feel the inequalities of the ground, notwithstanding the bad condition of the road. The propeller slowed down quite often and even stopped, as the cam shaft of the motor which commanded the valves frequently became displaced at the dead point each time that he let go of the lever which moved it and which held it in position. In the last trial, with the wind blowing from the side, M. Vuia increased the admission of steam and the machine suddenly rose to a height of about two feet. Unfortunately, as soon as the apparatus left the ground, the propeller slowed down and the machine, driven by the side wind, after several balancings, landed on the ground so gently that he was not able to feel the least shock or to know the exact moment when it touched the earth. After it landed, the machine was overturned by the wind, and the propeller and three of the sustaining tubes were damaged. The distance traveled in the air was about forty feet. The inventor estimates that the speed attained by the machine was about thirty miles an hour, while he states that the power expended was only about a third of what he had at his disposal. The aeroplane was inclined at an angle of 10 degrees.

As the result of these experiments M. Vuia has reached the following conclusions:

1. As soon as the machine acquires a certain speed the lifting of the wings is sufficient to counteract any inequalities in the ground.
2. As soon as the propeller stopped the machine did not run more than 60 to 90 feet on the ground, while formerly, when not furnished with the wings, it ran fully 450 feet after stopping the propeller. This demonstrates that the resistance opposed by the wings annuls very quickly the momentum of the machine.
3. The resistances of the frame and of the chassis of a machine of this type, at the speed necessary for soaring, are so small as to be negligible.
4. The power necessary to raise an aeroplane is much less than that claimed by experimenters.
5. That an aeroplane is not a dangerous machine if simple means are employed for launching it.
6. An aeroplane mounted on pneumatic-tired wheels can be started easily, even upon bad roads.

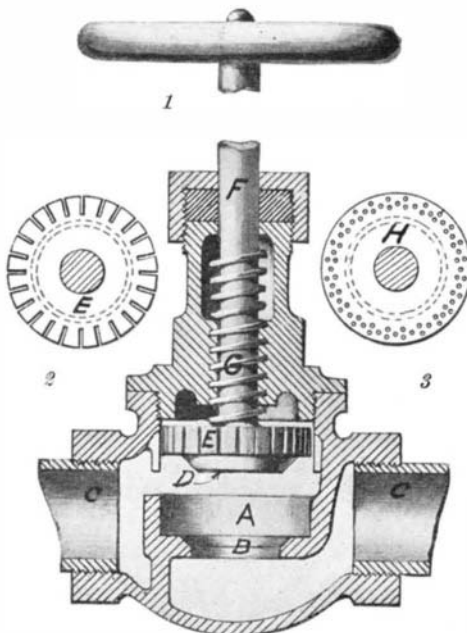
The Vuia aeroplane consists of a pair of wings mounted upon a framework of steel tubing, which in turn is supported upon four pneumatic-tired wire wheels. The weight of the entire apparatus, with operator, is 803 pounds. The wings are 7.87 feet wide from front to back, with a total spread of 28½ feet. A 7¼-foot propeller having a 7¾-foot pitch is placed beneath the wings in front and is mounted directly on the shaft of the 25-horse-power carbonic-acid gas motor.

The services which automobiles can render in military operations are becoming more and more appreciated in the Austrian army. A series of practical maneuvers which were exclusively reserved for automobiles and motor-cycles took place not long since over the route between Prague and Reichenberg. In these maneuvers were represented the Automobile Club of North Bohemia, the motor-cyclists of Reichenberg, and the chauffeurs of Prague and the vicinity. The

idea followed in the maneuvers was to take possession of the bridges of the Elba which were menaced by the enemy's cavalry, while the cavalry which were charged to defend them would not have time to arrive on the spot. These maneuvers presented the greatest interest and are another proof of the great services which the cars and motor-cycles will render in time of war.

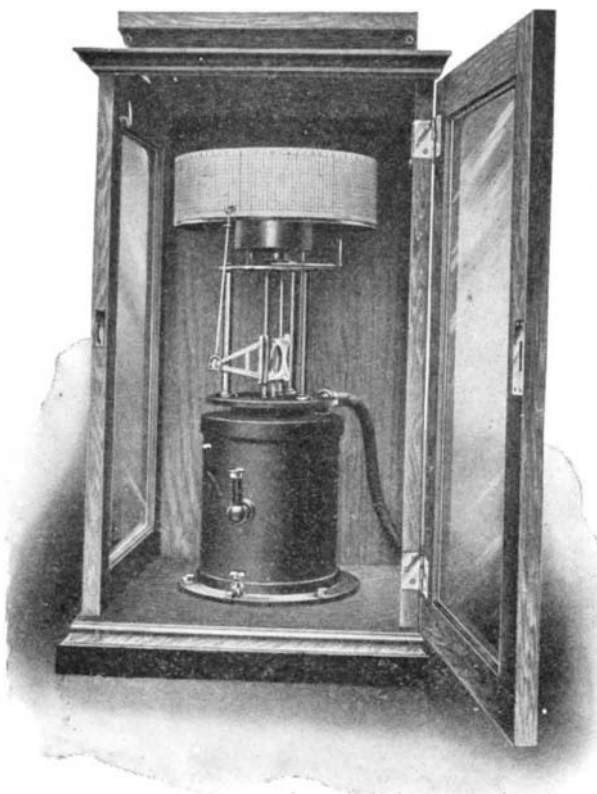
AN IMPROVED VALVE.

The valve illustrated in the accompanying engraving has been designed with a view to preventing scale or foreign substances being caught on the valve seat as the valve is being closed. As is well known, this is a common source of trouble with valves, for the obstruction either prevents the valve from entirely



AN IMPROVED VALVE.

closing, or else is imbedded in the valve seat, thus injuring the latter. The present invention proposes to overcome this difficulty without restricting the flow of fluid and scale through the valve, except at the time of closure. Under normal conditions, when the valve is open, both fluid and scale may pass through as in other valves, but while the valve is being closed the fluid is strained, though sufficient fluid is permitted to pass through the valve to wash the seat clear of all obstructions. Our illustration shows a valve casing of the globe type, the seat being shown at A B, and the service pipes entering at C and C. The valve seat comprises a recess, A, with a vertical wall, and the seat proper, B, which has a tapered end. The valve comprises a tapered portion, D, adapted to fit snugly in the seat, B, and over this is a strainer disk, E, which is adapted to be seated in the recess, A.



AUTOMATIC DEPRESSION RECORDER FOR THE SCIENTIFIC CONTROL OF MINE VENTILATION.

This strainer disk, as shown in one of the detail views, is formed with radial slots cut in its periphery. The valve is carried on a stem, F, formed with a thread, G, so that it may be fed in the usual manner toward and from the seat. In practice, when the valve is being closed the strainer disk, E, will first enter the recess, A, and thus prevent a flow of scale or other

obstructions with the fluid through the valve. However, a quantity of fluid will flow through the slots and clear the seats, A and B, of obstruction, so that when the valve is lowered to its fullest extent, there will be nothing to interfere with a tight closure of the disk, E, with its seat, A, or the plug, D, with its seat, B. As a modification of this construction, a strainer disk of the type shown in Fig. 3 may be used. This disk, H, is formed with a series of perforations instead of radial slots, thereby producing a more thorough straining of the fluid. A patent on this improved valve has recently been procured by Mr. Charles E. Simpson, of 808 Gallia Street, Portsmouth, Ohio.

AN AUTOMATIC DEPRESSION RECORDER FOR THE SCIENTIFIC CONTROL OF VENTILATION IN MINES.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The existing methods of ascertaining the state of the ventilation of a mine by means of a water gage on the record of the speed of the fans is unsatisfactory, because of the fluctuating conditions which always prevail and the absence of any means of determining whether the ventilation remains constant. Consequently, these systems by no means afford an adequate provision against the very serious dangers of insufficient ventilation.

With the new recorder illustrated, a continuous record of the volume of air actually drawn into the mines by means of the fans, as inferred from the depression in the shafts, is obtained, and the engineer can at all times accurately ascertain whether or not ventilation is efficient. The construction of the instrument is based upon the hydrostatic principle.

The recorder comprises a cylinder in which works a perfectly-balanced float, of great sensitiveness, moving in an inner receptacle. Instead of using water, which occasions constant trouble through evaporation and condensation, whereby the volume is continuously varying, glycerine is employed, so that recharging and adjustment of the apparatus are obviated. The instrument is attached directly to the ventilating shaft by means of a flexible tube connected with the device just below the cover plate. The depression existing in the shaft acts upon the surface of the glycerine contained in the vessel surrounding the central chamber, thereby causing a movement either upward or downward of the glycerine within the inner cylinder containing the float.

Attached to the float is a beam or lever carrying the recording pen, which inscribes the reading upon a calibrated cylindrical chart attached to the top of the instrument. The rod which connects the float with this registering lever passes through a large oval aperture in the cover plate of the glycerine cylinders, so that it has absolutely free play, and friction is entirely avoided.

When depression in the shaft acts upon the glycerine, the impulse thus set up is immediately transmitted to the recording pen, which makes a corresponding movement upon the chart, the zero line of which is at the top. A continuous record of the depression is obtained. The drum carrying the chart is fitted with a five weeks' clock movement, and records ranging over periods of twenty-four hours or seven days as may be required can be obtained.

A modification of the instrument has been used as a draft gage for boilers and furnaces.

Government Printing of the Official Gazette.

By reason of recent changes in the publication of the Official Gazette of the Patent Office, the entire work is now being produced by the Government Printing Office. The first number of the Gazette under the new method of publication was issued on July 3 last, and the appearance of the work reflects great credit upon the management of the Printing Office. The public printer has introduced new methods, which not only enhance the appearance of the Gazette, but decrease the annual cost of its publication, as well to a large amount. The rather antiquated and expensive photolithographic process, by means of which the pages were illustrated, has been eliminated, and the illustrations are now printed direct from zinc etchings incorporated in the type pages and mounted on blocks of type height. Formerly, these were reduced in size and reprinted from dummy cards. The appearance of the Gazette has given rise to general commendation, for the illustrations are far clearer and less difficult of comprehension than formerly. Patent attorneys all over the country are unanimous in declaring the issue of July 3 the best number of the Gazette which has yet appeared and that Commissioner Allen and Public Printer Stillings are to be congratulated on their success in this improvement.

Mr. George I. Rockwood, who is one of the leading authorities in this country on the subject of steam engineering, has been appointed to the professorship of steam engineering in the Worcester Polytechnic Institute. Mr. Rockwood graduated from the Worcester Polytechnic Institute in the class of 1888.