

## The Burning Mines of the Hocking Valley

By Harry A. Mount

ONE spring day in 1884—thirty-seven years ago—guards in seven mines in one of the finest bituminous coal fields in this country simultaneously discovered fire in their mines. The miners were on strike and it had been rumored the day before that strike-breakers were on the way. Oil cans scattered about the mine entrance gave evidence that the fires were the work of vandals.

Today the fire is still burning. It has rendered almost useless the entire coal deposit, extending over some seventeen square miles of territory between the little mining towns of Shawnee and New Straitsville, Ohio; it has actually destroyed more than 15,000,000 tons of coal under about 1,500 acres of this territory; it has turned a once prosperous community into a graveyard of hopes. Those few miners who still eke out an existence by working the outcroppings of coal in the fire district do so at the daily risk of their lives.

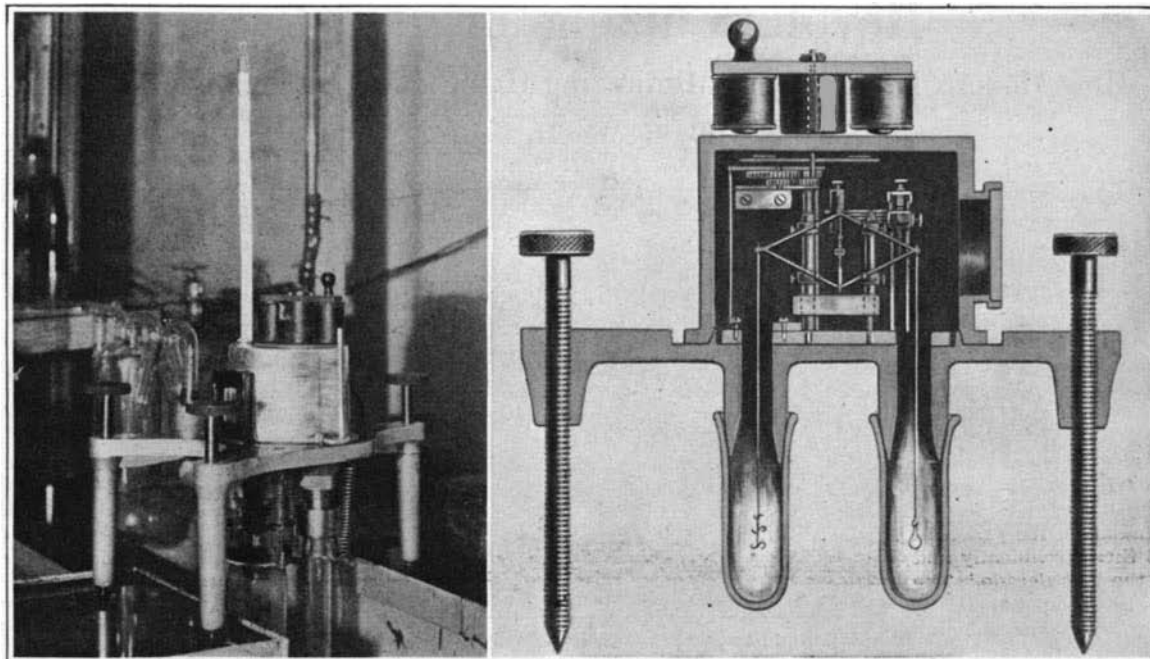
The fire has resisted elaborate efforts made by the state to save this enormous store of fuel and numerous efforts of private firms to save their property. The fire is burning more fiercely today than ever before and experts of the Ohio Bureau of Mines say it is just getting a good start! It is predicted that it will burn for nearly a century to come with little hope that it can ever be extinguished.

The fire is in a particularly fine vein of coal in the Hocking Valley district. Nearly the whole vein is practically free from slag and is from five to twenty feet in thickness. That part which already has burned averaged about ten feet in thickness.

The fire is particularly difficult to control because of the fact that most of the coal is near the surface, running from ten to fifty feet deep, much of it being suitable for stripping operations. As the coal burns out the ground sinks, causing fissures in the earth through which the fire receives a new supply of oxygen.

Not only has the fire destroyed an enormous store of good coal, but it has wrecked a whole countryside. Lands have been burned brick-red by the great heat from beneath, destroying all vegetation and rendering the ground unfit for cultivation. Scores of homes have been abandoned and have tumbled into the sink holes that engulf the country in the wake of the fire.

One whole village, the town of Old Straitsville, has been abandoned. Wells in this vicinity are sometimes boiling hot and there are steaming streams running through woods in which the trees have been burned off at the roots and have toppled over in confusion. Occasionally the pent-up energy of the burning coal bursts forth in a miniature volcano, and at night scores of these craters can be seen from a hill-top in the heart of the fire district. Paved roads have been undermined and have sunk in. In brief, the fire district presents a picture of the utmost desolation. The few persons who have remained



The quartz-fiber micro-balance that is sensitive to a millionth of a milligram, and a drawing showing its construction

with their lands are retreating stubbornly before the advance of the fire but without hope. Only those mines in which it is possible to secure good ventilation can be worked and even then they have to be abandoned long before the fire actually reaches them because of the presence of the deadly fire damp.

One miner owned a considerable section of rich land and was moderately wealthy. The single opening he can work will soon have to be abandoned and it furnishes now a meager living by hauling coal from it in wagon-load lots. One day last summer his small herd of cows went into the entrance of an old mine, attracted by the cool shade, and next day he found them there all dead from fire damp. Their bones are now cremated.

The writer came upon a gang of five men in the heart of the fire district engaged in making a new entrance to an outcropping vein. The entrance they had used the day before was now a roaring furnace. During the night the fire had broken through from an adjoining shaft. There was an explosion that shook the surrounding country and which blew a twenty-five foot crater in the hillside. This formed a sort of natural flue for the burning mine and flames roared fifty feet into the air. The men intended to blast down the burning section of the mine to retard the fire while they opened another entrance. This would allow them to work a few more days before the fire caught up with them.

About a hundred feet from where they worked was a stream of steaming water, which, they said, was hot

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## Weighing the Ten-Millionth of a Milligram

By Dr. A. Gradenwitz

WHEN a young Swedish physicist, Dr. Hans Pettersson, in the fall of 1911, commenced his work at the University College, London, the subject suggested to him by Sir William Ramsay was a closer investigation into a curious phenomenon observed by himself, viz., the temporary loss in weight of a tiny gold capsule raised to a red heat. The quartz micro-balance designed by Steele and Grant was to be used in this connection and the newcomer to Sir William's laboratory was to try even to improve it, so as to make it stronger and less difficult to work with. This difficult problem was solved most satisfactorily, the work being later continued at Stockholm.

The knife-edge support of the balance was replaced by a suspension consisting of a pair of quartz fibers, a magnetic arrestment being employed. The thinnest portion of these fibers, viz., the portion bent during oscillations of the balance, is only a few thousandths of a millimeter thick, thus being invisible to the eye and requiring, to be made visible, a strong side illumination under which it appears as a rainbow-colored gleam, the tint indicating the thickness of the fiber. The bearing capacity of these extremely thin fibers was found to be unexpectedly high, amounting to several grams, which corresponds to the strength of hardened steel. The drawing out of the fibers is effected in a few moments in the oxygen flame at a temperature corresponding to a white heat. This does away with the whole laborious work required in sharpening and adjusting the knife-edges used in connection with ordinary balances. The fibers are also of a remarkable flexibility, thus enabling the sensitiveness to be driven to figures so far unheard of. Moreover, on reducing the thickness of the fibers the flexibility will increase more quickly than the bearing capacity decreases so that the new micro-balance, in opposition to all those so far constructed, will work the better as it is made smaller.

The construction of the first micro-balance designed on these lines demanded several months' laborious work, though, on account of the unprecedented sensitiveness obtained, it proved to be worth all the pains taken. When Dr. Pettersson's work was continued at the University of Stockholm, the street traffic, during those

nights when the most delicate tests were made, was deviated from the university building.

The beam of the balance is entirely of quartz. In the one recently constructed it is only 5 centimeters long and weighs a fraction of a gram. Weighings are taken in a hermetically closed case inside of which the air pressure can be reduced as far as a very high vacuum, thus varying the upward pull of the air on a minute air-filled sealed quartz bulb suspended on one side of the balance. The variation thus produced in the effective weight of the bulb can be calculated with an accuracy of fractions of (Con'td page 457)



Left: A fissure in the ground through which red hot earth can be seen. At night such spots as this dot the countryside with cherry-red patches. Right: The day before this picture was taken work was going on as usual in this shaft; now it is a roaring furnace

Scenes on the ground under which Ohio's great subterranean fire rages

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clear. They bought the land with the expectation of checking the flames and stripping the earth from the coal so that it could be mined cheaply and quickly. Before they could begin operations fire appeared on their land. All attempts to halt its progress have been futile. Brick walls were built across the mine tunnels with the hope of smothering the fire, but these apparently had no effect. Double brick walls were then tried and after that a space was walled off and filled in with dirt. This latter scheme was partially successful and believing the fire was extinguished, preparations were made to strip the land, but before these were completed three new craters were blown out and the fire started with renewed energy. By this time the firm's finances were exhausted and the project was given up as hopeless.

The State of Ohio likewise has abandoned efforts to stop the fire after several ineffectual attempts. In one of the earlier attempts water was pumped into one of the mines for three years continuously. At the end of that time no impression had been made on the fire. It is believed the intense heat turned the water into steam before it reached the coal, rendering it ineffectual. Chemicals also were tried without success. In some rare instances the fire has been stopped in spots, only to break out in others near by.

This is really the principal difficulty of the situation. If the fire were burning in a single direction or from one center, it might be stopped at an expense justified by the value of the coal to be saved. But the fire has burned most readily along the outcroppings of the vein and as a result it is burning in hundreds of places scattered all over the territory.

The fire is the cause of many freakish occurrences. Not long ago an aged miner was looking at a section of sunken road and commented on the soundness of the ground he was standing on when it suddenly gave way. He tumbled into what had been an old shaft and he was able to make his way out without injury.

In the spring the vegetation on ground warmed by the fire to the proper temperature becomes green and the flowers bloom a month or more before the usual season. Other areas are so hot that even in winter heat waves arise from them as though from a giant stove top. Smoke issues from the most unexpected places. In one spot smoke issued from a hollow tree although no other smoke appeared near by.

The most imposing sight, no doubt, is at "Smoke Valley." It is, as its name indicates, a wide valley which has all the appearance of a giant cauldron. In places here the earth has been churned by upheavals and sinkings until it resembles a shell-torn battlefield. The simile applies as well to the whole region. Certainly the battle areas of France present a picture of desolation little more striking than this.

## Weighing the Ten-Millionth of a Milligram

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a millionth part of a milligram, the volume of the bulb and change in air pressure being known. Minute weights of pure quartz are used as well, the value of which has been ascertained by comparison with "air-weights." An alternative method consists of using "magnetic weights" in the place of air-weights; this involves the use of a measured electric current. The range of weighings depends on the size of the beam; with one .5 centimeters in length the maximum load is between 100 and 200 milligrams, and the setting can be made to within a ten-millionth part of a milligram.

The oscillations of the balance are read by optical means, a beam of light being

reflected on a vertical scale from a minute mirror fixed to the beam of the balance. The mechanism of the balance by which its beam is suspended from or lifted off the fibers is controlled by an electromagnetic arrangement, without any material connection through the walls of the balance case.

Some important improvements, viz., an arrangement allowing the quartz fibers within a few minutes to be placed in position or detached and an attachment for varying the sensitiveness of the balance, are due to Dr. Strömberg. If a fiber should be accidentally broken a reserve fiber can be quickly inserted without removing the balance from its place, in fact, with the same ease as a string is replaced on a violin.

A balance surpassing a hundred thousand times the sensitiveness of the ordinary chemical balance, of course, opens up practically unlimited possibilities of scientific research and is bound to become indispensable to physical and chemical laboratories. Some highly interesting subjects have already been investigated by Dr. Petterson, viz., the gradual loss of weight of a silica sphere in a vacuum at temperatures of 600 to 800° Cent., the changes in weight of a piece of gold subsequent to heating, and the magnetic properties of pure nitrogen and hydrogen gas. It is now expected to investigate the pressure of light, the measurement of absolute temperature, and the loss of mass accompanying loss of energy.

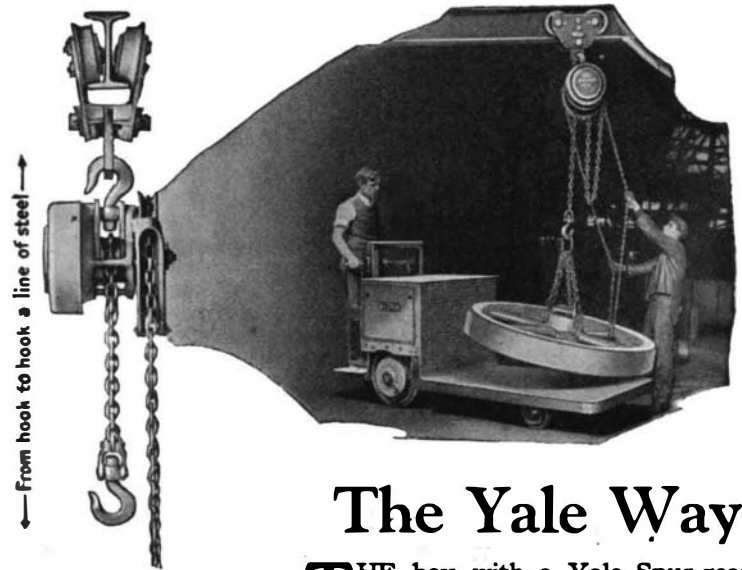
## Revolutionizing an Industry

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Wisconsin has found that community co-operation is fundamentally essential for the practical and profitable production of hemp. Machinery for harvesting the crop is expensive and usually must be owned in partnership by a number of neighbors. The mills for separating the hemp from the woody stems cost anywhere from \$10,000 to \$50,000, depending on their capacity and equipment, and must be necessarily located in sections where hemp growing is a permanent business. It is essential that from 500 to 750 acres of hemp be produced annually to keep each of these mills busy. This involves the concentration of production around definite milling centers so that sufficient raw material is assured to make the operation of the mills profitable.

To a certain extent hemp is a crop which prospers only under proper conditions of soil and climate. It is not adapted for universal culture in all parts of this country but it provides propitious opportunities for successful production in territories where the local environments are favorable for its growth. It prospers in the humid sections of the temperate zones, although some of the birdseed varieties mature in from two to three months in northern Russia. For seed production, hemp demands a growing season of six months or longer while for fiber production it will mature in four months. Hemp has been produced successfully in the United States only in sections where the annual rainfall amounts to at least 30 inches. Wisconsin's climate is excellent for hemp growing as the autumn months are cool and moist, conditions which promote the efficient seasoning and retting of the fiber.

It is essential to harvest fiber hemp at the right stage of maturity or else deterioration will result. Under Wisconsin conditions, hemp harvest season occurs between September 10th and October 1st. Practically all the foreign supplies of hemp are still harvested by hand and it has only been since 1917 that an efficient mechanical harvester has been perfected and extensively used in this country. It cuts the hemp and spreads the stalks in even swaths, performing this work much better than it can be done by hand. The American hemp crop is produced by dew-retting systems, that is, exposing the hemp to rains, dews, frosts and sunshine



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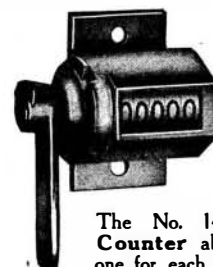


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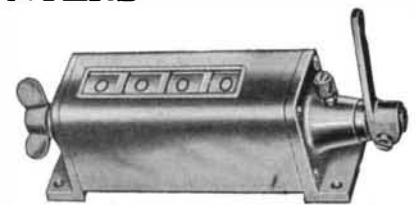
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