SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) .... $3.00 a year
Scientific American Supplement (Established 1876) .... 5.00 "
Scientific American Building Monthly (Established 1885) .... 2.50 "
Scientific American Export Edition (Established 1878) .... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, JULY 23, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

WHAT WE INHERIT WITH THE PANAMA CANAL.

With American control of the Panama canal opening the second chapter in the story of the great isthmian waterway, we inherit a graveyard of many wrecked hopes and lives, with their monuments strewn from the Atlantic to the Pacific in the shape of decaying relics of an earlier engineering period. There is no richer digging in the ruins of an ancient Rome or Pompeii than along the deserted route of the canal. For upward of a quarter of a century some $20,000,000 worth of decaying machinery, buildings, and engineering implements have been buried in the moist soil. In nothing was the early French company more extravagant than in purchasing supplies for the isthmus. These included nearly everything that man could think of, and the shipments of the goods to the isthmus kept employed a small fleet of large and small ships. Every steamer that touched the isthmus in those palmy days of canal digging unloaded stacks of supplies for the engineers and their subordinates.

There was machinery by the scores and thousands of tons, large, small, and medium size; costly machinery and antiquated types of no real value at all; machinery that was to be used, and machinery intended for waste; machinery that was as much out of place in that far-away corner of the earth as steam radiators in the Desert of Sahara. Why this endless amount of machinery was shipped there, no one could explain; but it was all accepted, paid for, and then left to rot in the hot, moist climate. There were locomotives from Belgium and the United States, enormous steam hammers from England, great turning lathes from Germany, scoops, buckets, steel rails, and machine tools by the acre from all parts of the earth.

There were no storehouses sufficient to hold all these supplies. There are 2,431 buildings on the isthmus left by the old Panama company, many of which are hospital buildings and executive offices, but not all of these could store the machinery sent down to help dig the canal. What wonder, then, that machinery became ordinary articles of common use? Engineers and contractors stored what they could, and turned the rest out of doors to the tender mercy of a climate that quickly destroys steel and iron.

There were some who used the iron as foundations for their costly homes. Along the line of the canal, the silt of the soil is often as soft and slippery as quicksand. It filters through and into everything. It made the building of the canal a difficult engineering problem for the French, which they could never quite overcome. When you build substantial houses of stone or iron upon the running soil, there is no surety that the foundations will last. Some of the large houses built by the French officers of the company sank down into the silty soil, until to-day only the upper stories are visible. So, to make their homes more secure, some of them used the surplus machinery as foundations. There are houses on the isthmus that stand on $50,000 worth of machinery, which was never used for the purpose intended.

In many similar ways the surplus machinery was employed to keep it from standing idle. In parts of the isthmus it is found buried ten and fifteen feet below the surface soil. Unearth it, and you find it as soft and porous as cheese. It may be a huge iron anchor, a steel bucket, or a cast-iron scoop, that protrudes above the soil to attract the attention. With a penknife it can be cut and pared as easily as if it were an apple. In some mysterious way, the soil and climate has disintegrated the metal, so that its hardness has disappeared, and while retaining all of its outline and outward characteristics, it is no longer iron or steel. One wanders along the line of the canal to pick up odd pieces of relics, only to find them crumbling under the touch.

Not all the machinery, however, has been cast aside to sink into the loose soil of the canal. At Colon and Emperador it is scattered over miles of land that has been set aside for this purpose. Here, indeed, is the graveyard of France's past ambitions. One stumbles upon the monuments of a past which will forever live in the memory of those in any way associated with the Isthmus of Panama or the canal. Millions upon millions of useless, rotting, neglected property stands exposed to the disintegrating influences of the climate, sadly out of date now and fit only for the junk pile, but teeming with memories and possibilities of the glorious past.

There are miles upon miles of steel rails piled six feet high, sinking slowly into the soft soil, and rusting in the moist atmosphere. Rows upon rows of car wheels are apparent on every side, wheels which represent huge expenditures, but which were apparently simply dumped there and never used. Iron and steel buckets and scoops form an army of silent witnesses to man's folly and wasteful extravagance. Machine shops, filled with huge steam hammers and giant turning lathes for repairing the machinery used in excavating, are falling apart by their own weight. A dozen rows of locomotives—small in size and weight, and scarcely adapted to the work required of them—stand half sheltered under sheds that are themselves hardly able to stand up under their aged and weakened rafters. Rust and decay are apparent on these locomotives, as well as upon all other articles of use, and the hand of neglect appears stretched over the whole length and breadth of the isthmus.

When the trade winds die out, and the hot, sultry air of the isthmus ceases to move, a white mist will sometimes rise out of the swelling ocean, and hover like a fog over land and sea. This white mist is the precursor of fever and sickness, and those of the isthmus who know remain within doors, unwilling to meet the ghost of the ocean half way.

In the early days of the canal history, the white mist that rose from the disturbed soil of the isthmus was far more disastrous in its killing effects than the mist of the ocean. It rose from the soil like incense from a brazier. It carried with it from its underground prison all the poison of putrefaction, and wherever it inclosed its victims, there fever and death followed. The soil is moist and damp, and when disturbed in that hot climate, it releases a dense white mist. For generations past luxuriant vegetation has been decaying in the soil, and when the surface is scratched, strange, unhealthy gases and poisonous vapors rush upward to spread around. Tier upon tier of annual crops of rich vegetation are packed down solid over the surface of the soil. In this hotbed of feverish decomposition, the process of fermentation and disintegration is ever in active operation. Fortunately, nature holds most of the deadly exhalations in close prison walls; but when man comes along to disturb the even balance, trouble begins. In the hot, damp air of the isthmus, the poisonous exhalations released from the soil mingle with the mist, and the "white ghost of the canal" is accounted for. When the Frenchmen excavated for the canal, the mist hovered over their camps and homes during the greater part of the year. It entered nearly every home to claim its victims. Men died like beasts in the field. They were stricken at their work, in their tents, in their beds, and even at the gaming or wine and card table. It was all one with the monster; it knew neither rank nor condition, wealth nor poverty. Only the native knew enough to avoid it, and to keep away from the fever camps of the company.

COST OF ELECTRIC HEATING.

Efficiency in electric heaters is perfect at one hundred per cent. In other words, all of the energy absorbed as electric current reappears as heat.

This is true of no other type of heater. An ordinary coal or wood stove gives off only one-quarter to one-half of the heat energy of its fuel. Radiators in the best steam and hot-water plants yield about seventy per cent of the latent heat of the coal burned in their boiler furnaces.

The remainder of the fuel energy escapes from the boilers in the latent heat of the unburned gases, and as sensible heat of the products of combustion.

Gas heaters, like stoves and furnaces that burn wood and coal, are subject to losses of heat because of imperfect combustion and also because of the high temperature of the escaping products. Probably fifty per cent is as high an efficiency as can ordinarily be expected with gas stoves.

All of the foregoing applies to those cases where electric heaters, wood, coal, or gas stoves, or steam or hot-water plants are employed to warm the air in buildings. Where either coal or gas stoves or furnaces are used for cooking or industrial operations the efficiency between the fuel and the work is in almost all cases an unknown quantity. Thus, who can say how much of the contained heat energy of fuel enters a mass of bread baked by it; or what percentage of the heating power of gas or coal is absorbed by a smoothing iron? About all that can be done in such cases is to determine how much fuel must be expended per pound of bread baked or for each smoothing iron per hour when maintained at a given temperature.

In almost every instance where combustion is employed to develop the heat for industrial operations there is a great and necessary loss between the fire and the object to be heated. This is due in part to the fact that the fire and its containing stove or furnace is large and the object to be heated is small, so that while heat is escaping by radiation and conduction in every direction, it is utilized in only one.

Where electric heaters are applied to industrial operations, most of these losses just named are avoided, because the energy is transformed at or within the object to be heated. Thus an electric stew-pan has the heat developed in coils attached to its bottom, and such coils are actually within the electric smoothing iron. This feature gives electric heating a great advantage in point of economy for most industrial operations. So great is this advantage, that in most industrial applications of heat it is probably necessary to burn several times as much fuel if the heat is transmitted directly to the objects on which it is to act as when it is developed there by electric current. It seems certain, therefore, that electric supply systems can well afford to make rates for current that will insure its application to cooking on a large scale and to special heating in manufacturing plants, especially where current for these purposes can be delivered at times during each twenty-four hours when the power and lighting loads are much below their maximum. Users of heat for special purposes find it to their advantage to pay something more than their former expense for fuel in order to procure electric current to do the same work, because the labor and risk of local fires are thus saved. Applications of electric heat along industrial lines are now rapidly multiplying and its ultimate triumph in that field seems assured.

For the general heating of the air in buildings the prospects are not so encouraging. Even here it seems, however, that there are many cases where electric heaters may displace those that burn coal or gas. The range of the problem may be gathered from the fuel cost of heat from gas or coal. Even in years when there is no strike among the miners $7 per ton is not an unusual price for the first grades of anthracite coal. At this price per ton of 2,000 pounds the cost per pound is 0.35 cent. Each pound of such coal yields on perfect combustion about 12,000 heat units, but in house fires generally the heating effect actually obtained is probably no more than 30 per cent of this, or say about 3,600 heat units per pound. One kilowatt hour of electrical energy is the equivalent of 3,438 heat units, and many electric systems are now able to deliver this amount of energy to consumers on a consumption of three pounds of soft coal costing 0.33 cent when this coal can be had at $2.50 per ton of 2,240 pounds in carload or shipload lots. Under the several assumptions just made it appears that the cost of fuel in the electrical supply system per kilowatt hour delivered is just about equal to the cost of anthracite coal to develop an equivalent amount of heat on the premises of a consumer. The question then is whether consumers will pay enough above the amount which either they or the electric supply company must expend for fuel, to induce that company to operate its plant for heating when the power and lighting loads are small. Considering the saving of labor to consumers, the fact that electric heat can be applied instantly when wanted, and that no combustion or gases accompany its production, it seems that this question must have an affirmative answer in many cases.

Illuminating gas is finding extending application in the warming of buildings, but in safety and in its effect on confined air it is much inferior to electrical energy for this purpose. It is also sound to assert that during many hours in each twenty-four electrical energy can be profitably sold for heating at rates that make it at least as cheap as illuminating gas at the lowest common prices.

Comparatively few cities in the United States have a rate as low as $1 per 1,000 cubic feet for illuminating gas. At this rate the entire heating power of the gas obtained for one dollar is about 650,000 heat units, but owing to imperfect combustion and to the high temperature of the burned gases, hardly more than 325,000 units of heat are made available for general warming with ordinary gas stoves, for each thousand feet of gas consumed. This gives 3,250 heat units for one cent. At the rate of one cent per kilowatt hour the electric heat available for that sum is 3,438 units, or a little more than that obtainable from gas at an equal cost. As low a rate as one cent per kilowatt hour is already made in many instances to large users of electric motive power during the regular working