Internal Combustion Engines.

At a recent meeting of the Engineers' Club of Philadelphia, Mr. Paul A. N. Winand presented some figures as to the cost of power in using internal combustion engines.

"The attendance in gas and oil engines is probably not more than in the engine part of the steam engine, and in the newer styles of gas engines, working without slide valve, the amount of lubrication is also about the same, and in a comparison between the two classes of engines, these items can be omitted.

"Considering the question of cost of power in a general way, that is, independent of any combination with other apparatus, gas and similar engines are often cheaper to run than steam. Illuminating gas costs generally from $1.00 to $1.50 a thousand. As shown in the Society of Arts trials, a gas engine of about ten horse power can be run with 22·6 cubic feet of gas per brake horse power. Better results than this have been obtained, but at this figure the cost is 2·2 to 3·3 cents per horse power. This is about equal to 13 to 19 pounds of coal at $3.50 a ton. Nevertheless, it is mostly cheaper than steam for powers up to fifteen horse power, especially when the plant is run spasmodically. When a gas engine is used to make incandescent electric light, 22 cubic feet of gas will be used for about nine 16 candle power lamps, or 140 candles. The same amount of gas burned as such would give only about 90 candles. The number of lamp hours per year will decide as to whether it is cheaper to burn gas directly or not.

"In actual work a gas or oil engine keeps more nearly to its original economy than a steam engine, because a steam engine will run with valves and pistons in bad order, while a gas engine refuses to go if the supply of gas is not about properly adjusted.

"In an official statistical inquiry as to the economy of power, made by the authorities of Birmingham, the fuel consumed was much higher than might be expected from published results of tests, on non-condensing engines being not below 9·6 pounds, with an average of eleven pounds of coal per horse power hour.

"Oil or gasoline can be used with about the same efficiency as gas. One gallon of oil is about equivalent to 180 cubic feet of illuminating gas, and, accordingly, it takes about one-eighth of a gallon per horse power hour. This, at 5 to 10 cents a gallon, is equivalent to 7½ to 3½ pounds of coal at $3.50 per ton.

"With natural gas 15 cents per thousand, one horse power costs about one-fourth of a cent, as it takes only about 16 cubic feet per horse power hour, and it would take three to four times as much gas firing under a boiler for the same power. Using the coal in a producer to make gas and then using it in the gas engine for power is one way of running a gas engine plant. The efficiency of a gas apparatus is from 70 to 80 per cent. With such an apparatus, a consumption of 0·935 pound of coal has been attained in France, and even 0·883 recently per horse power hour in England."

Mr. Strong—One of the most interesting papers I have read on the subject of the cost of power was by Sir William Thomson, in 1881. In this paper the sources of power were divided into four, which were wind power, falling water, tidal energy, and coal. The first two of these are due directly to the sun's heat, and, what might at first appear strange, the first of these has had more to do with the comfort and progress of this world than any other power, and it is probable that the time will come again when wind power, in connection with some such apparatus as the storage battery, will again do the work of the world.

Tidal energy and water power he regarded as insignificant. The burning of coal he also considered as one of the sources of power which was derived from the sun's energy.

Prof. Elihu Thomson read a paper in Boston recently, and said that the hope of the electrical engineer was in the steam engine, or that the mechanical engineer would produce cheaper power than by the steam or gas engine.

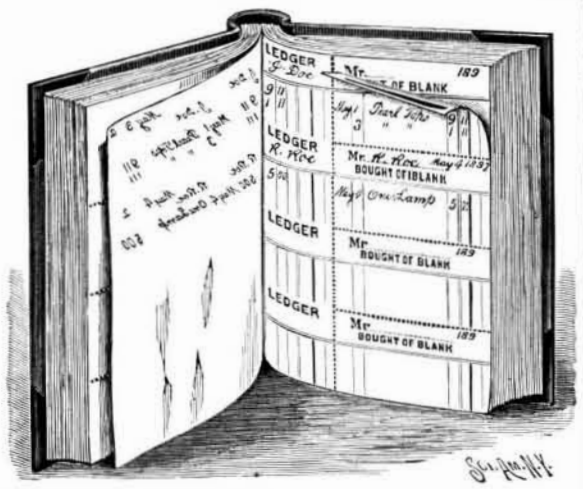
Clark says that it is possible to use 40 per cent of the energy in the coal through the gas engine, while the best steam engine only uses 13 to 14 per cent.

The difficulty in the way of introducing producer plants and gas engines is the first cost and the difficulty of starting the engines, but this latter difficulty will probably be soon overcome, and the gas engine will then supersede the steam engine in many cases. We have been engaged in designing an engine which is to make a horse power on 13 pounds of water, and in the boiler we expect to carry 180 pounds pressure, allowing the gas to escape at 250°, and evaporating 12 pounds of water to a pound of coal.

NITROUS acid as a disinfectant had been proposed some years ago because of its peculiar property of being an oxidizing as well as a reducing agent. H. Borntrager employs the following combination containing 20 per cent sodium nitrite: One part sodium nitrite and one part gypsum are melted together; after cooling the mass is powdered and preserved in well-stoppered receptacles. Two parts sodium bisulphate and one part gypsum are also melted together and, after cooling, powdered. Both powders are now mixed and preserved in dry and tightly-stoppered containers. If this powder be thrown into water or substances to be disinfected, a uniform evolution of nitrous acid takes place, which rapidly destroys foul odors.—*Pharm. Centralhalle.*

A COMBINATION ACCOUNT AND BILLING BOOK.

A book which combines within itself three books, such as used in mercantile business, is shown in the accompanying illustration, and has been patented by Mr. James E. Depue, of Oakland, Cal. The combination embraces a general ledger, a sales book or personal ledger, and a billing book, and is designed to lessen



DEPUE'S LEDGER, SALES AND BILLING BOOK.

the labor of the book-keeper, and facilitate the keeping and rendering of accurate accounts, while doing away with a multiplicity of books. The book contains two classes of leaves bound together, main or entry leaves and intervening transfer or copying leaves, whereby a press copy may be taken of the writing on the main leaves. Each of the latter has its inner end portion ruled to form a column of ledger spaces, the front portion of the sheet having, opposite each ledger space, a space corresponding to the leaves in a sales book or a billhead book, ruled to enter the usual items of account, dates, charges, etc., each of these spaces also bearing a special number printed in copying ink. This outer portion of each main leaf is designed to be detached when desired, for presentation as a bill or memorandum, and this portion of the sheet is therefore separated from the ledger spaces by a vertical row of perforations, to facilitate its ready removal, a press copy of the account being previously taken on the copy or transfer leaf. The latter, remaining bound up in the same book as the main sheets, shows the general ledger account from the inner portions of the main sheet, and the personal ledger or itemized accounts from the outer portions, and may also be detached for presentation to customers if required, a bill being thus ready to detach and present to a customer at any time.

A DESK INK BOTTLE.

An ink bottle particularly adapted for use on school or other desks is shown in the accompanying illustration. It is provided with a simple, convenient, and

HALL'S INK BOTTLE.

reliable attachment, affording means for the secure connection of the filled bottle with an aperture in the desk, the orifice in the bottle being flush with the upper surface of the desk top and the body of the bottle being hung in the desk. The aperture in the desk is made of a size suitable to receive a cylindrical thimble with a radial flange, which, when seated on the desk top, retains the thimble in place. The neck of the bottle has an exterior thread loosely fitting a thread within the thimble, so that the parts are readily secured together in place as shown. The neck of the bottle is designed to be closed by a cork, and a laterally swinging cover, as shown, may be used if desired.

This improvement has been patented in the United States and Great Britain by Mr. William F. Hall, Box 247, Rapid City, South Dakota.

How Society is Indebted to Invention.

In the "Relation of Invention to the Conditions of Life," in the *Cosmopolitan Magazine*, Mr. G. H. Knight says:

With each step in industrial progress not only is the greater the number who can be warmed, fed, and clothed and the better are their life conditions, but in default of such progress a vast majority would not have lived at all. It is to industry guided by scientific methods, and to science that concerns itself with practical applications of its discoveries, that we are indebted for such magical arts as that which makes light itself depict for posterity the very features and expressions of the life it once illumined; for the kindred art whereby scenes in the most remote regions are made to pass in realistic panorama before the pleasantly cheated vision; for the instrument which, having analyzed the sunbeam and revealed the chemical constituents of distant constellations, becomes, in the hands of the metallurgist, the means of determining the precise instant at which to arrest the process of "conversion" in the Bessemer steel manufacture. It is to invention that society is indebted not alone for the refinements, but for every necessary of modern life; for food, clothing, and shelter; for the arts of spoken, written, and printed speech; for the means of flashing the very voice to a listener in a distant city, or catching the fugitive, tremulous tones and storing them for the delectation of generations yet unborn; for music, poetry, and the plastic arts; for locomotion by land, by sea, and even through the circumambient air; for the gift of soothing with healing wings the bed of anguish; for the ability from this tiny speck of earthly life to sound the abysses of time, thought, and space.

Wormy Tobacco.

In answer to a communication of Mr. E. L. Moore, of Glidden, Texas, relating to insects damaging stored tobacco, Prof. C. V. Riley says:

The question relates to the so-called cigarette or tobacco beetle (*Lasioderma serricorne*). This is a cosmopolitan insect, which feeds, all over the world, on a number of stored food products, and which, curiously enough, seems to have a preference for pungent stuffs, such as pepper, tobacco, etc. It has even been recorded as feeding upon Persian insect powder, probably, however, after this useful insecticide has lost some of its power through partial exposure to the air. In this country it has done considerable damage in tobacco factories, particularly from Baltimore southward. The female beetle lays her eggs in exposed tobacco, and from these there are hatched small white larvæ, which feed extensively for some weeks, afterward transforming to pupæ and issuing again as perfect beetles in from two to five months after the eggs were laid. Every precaution should be taken in factories to leave as little exposed tobacco about as possible, particularly at night, as the insects fly by preference at this time and lay their eggs. The factory windows should not be left open, and persons engaged in rolling cigarettes and cigars should cover their tobacco at night, while all waste tobacco should be swept up carefully and placed in some closed receptacle. Where a lot of tobacco has once become infested, the only remedy consists in steaming it thoroughly. The application of any of the insecticide substances cannot be recommended, as their use would injure the tobacco and might prove dangerous to those who subsequently used it.

Smoke Turned into Money.

In his inaugural address to the North-East Coast Institution of Engineers and Shipbuilders the other day, Mr. Wigham Richardson referred to the chemical treatment of smoke. He said: "We know how the heated nitrogen and the carbon oxides, which used to be belched forth from the blast furnaces, are now used to raise steam in the boilers which supply the blowing engines; but Mr. Ludwig Mond, of the firm of Brunner, Mond & Co.—the same who has introduced the Solway process for making soda, and in so doing has hit many of our friends so hard—has, as I understand, gone much further. He burns his coals with artificial draught, and, conveying the gases into a chamber, he washes them with water spray, which causes every particle of soot or smoke to be deposited, and at the same time condenses and recovers the ammonia (a product of nitrogen and hydrogen), as well as the sulphurous fumes. I trust that I have not misunderstood Mr. Mond's figures; but I gather that to get an equal efficiency of steam-raising power he has to burn 125 tons of coal in place of 100 tons, and for every 125 tons of coal burned he recovers four tons of sulphate of ammonia. The fuel, if cheap (say $1.25 a ton), will cost $155, and the sulphate of ammonia at $60 a ton is worth $240. If results such as these can be attained the doom of smoke is sealed."