process has been exhibiting increased economies and larger possibilities. In general, the following analysis, made by Dr. Gideon E. Moore, of New York, may be taken as a sample of a non-luminous water-gas—a gas that is efficient for heating, cooking and all industrial purposes :

Nitrogen	4.63	Carbonic oxide	30.80
Carbonic acid	3.47	Marsh gas	2.46
Oxygen	.00	Hydrogen	45.88
Heavy hydrocarbons	.00		
Total			100.00

Another of the gas-fuels is "Producer-gas," dates back to 1846, and it began with the Siemens process. In generating this gas the aim is to preserve the combustible carbonic oxide and to restore the waste heat of the carbonic acid gas for utilization by means of regenerators. Late improvements include the introduction of the steam-blast for the addition of hydrogen to the product. The Siemens system was followed by the system of M. Ponsard, of Paris, which consists of the heating and expansion of the air so that when it comes in contact with the carbon of the fuel it will take up only one part of the oxygen, forming the carbonic oxide, instead of taking two parts of oxygen and forming the incombustible carbonic acid. The St. Gobian analysis of "Producer-gas" shows its contents to be substantially as follows :

Hydrogen	4 to 11 per cent.	Carbonic acid	6 to 7 per cent.
Carbonic oxide	15 to 19 "	Nitrogen	58 to 63 "

It is claimed in a recent report by the Board of Trade of Scranton, Pa., that anthracite coal has no equal as a gas-producing substance. That authority also asserts that the anthracite culm may be utilized in the production of gas-fuel and sets down the cost of producing 100,000 feet of gas at $1.80, allowing 50 cents a ton for the culm, 30 cents a ton for the labor required to handle it, and $1 per ton for the expense of the plant. According to this computation the 20,000,000 tons of available culm now above ground in the Lackawanna Valley region would produce 2,000,000,000,000 cubic feet of gas, while the total supply of natural gas around Pittsburgh is estimated at 1,981,000,000,000 cubic feet From this it would appear that the exhaustion of the natural gas supply may well be considered an event of no great significance, because, even though the supply should give out in ten years, the ingenuity of man will have a substitute ready to take the place of the natural product without allowing the wheels of industry to pause a moment.

POINTS ON THE SLIDE VALVE.

A slide valve has no lap when the arch will just span the exhaust port and bridges, and the faces just equal the ports in width.

Lead is the amount of opening which a valve has when the engine is on the centre.

When a slide valve has neither lap nor lead the eccentric is set at an angle of 90 with the crank on the side toward which the engine is to run. Moving the eccentric forward makes the action of the valve earlier with reference to the crank in all its points.

Moving the eccentric backward makes the action of the valves later with reference to the crank in all its points.

When the blade of the valve exceeds the ports in width the amount which it projects over the edges of the port when in its central position is termed lap. The projection over the outside edge of the port, i. e., the edge at which the opening for admission takes place is called the outside or steam lap ; the lap on the inside or arch side of the blade is called the inside or exhaust lap.

When outside lap is added the eccentric must be set enough further ahead of the crank to take the lap up, i. e., so that the valve may be all ready to open when the engine is upon the centre. Usually a little lead is also given in order that the steam may get in on time and the port be opening as the piston advances. The effect of steam lap is to close the valve earlier and allow the steam to expand. The effect of inside lap is to close the exhaust earlier and introduce compression. —*Boston Journal of Commerce.*

AN OVERTHROW BELT.

It may appear difficult to find a case in belting where the tight fold comes on the slack side of the belt, and it must be doubtful if any benefit could be derived from a driving force that is working against the speed of the shafting, but there are places where such seems to be the case. A belt thrown on over another when there is quite a difference in the shaft wheels will bring the slack side of one just the reverse of the other. The outer belt, in running over the smallest wheel, has a tendency to travel the fastest, taking up its own slack and bringing the tight side where the slack for the under belt is found. But this negative driving of the outside belt must be taken in connection with the increased drive with the under belt, which has been made to cling to the shaft wheels with the binding force of both belts. A belt that cannot be made to drive without running so tight that there is nearly as much strain on the slack side as on the other, could well wear another of the same class on its outside for the benefit of the increased grip on the shaft wheels, although the inner driving stretch has all the load to carry.

NOMENCLATURE OF IRON AND STEEL.

Pig-iron is melted direct from the ore in the furnace, and contains 3 to 5 per cent. of carbon. When remelted it is called "cast-iron" or "metal."

Spiegel iron is precisely the same, but contains in addition from 5 to 15 per cent. of manganese.

Bar-iron, often called wrought-iron is pig-iron which has been smelted and deprived of nearly all its carbon, either in a puddling furnace or by the Wallon, Lancashire, or other analogous process ; the spongy mass or ball of iron is usually hammered or rolled into a bar.

Puddled steel is precisely the same as "bar iron," except that the process of puddling is stopped when rather more than half of the carbon has been removed from the pig-iron. There is consequently no hard and fast lines between bar-iron and puddled steel, the one intergrading to the other by imperceptible degrees. Although there are an infinite number of intermediate stages between the softest bar-iron and the hardest puddled steel, and although it is impossible to state the exact percentage of carbon which marks the dividing line between the one and the other, it is usual to call all puddled bars which cannot be hardened in water, bar-iron, and all those which can, puddled steel. This dividing line falls somewhere near a mixture containing ½ per cent. of carbon.

Blister steel is bar-iron which has been converted into steel in a converting furnace and varies in the amount of carbon which it contains from ½ to 1½ per cent.

Bar steel is blister steel which has been tilted or rolled down to the size required.

Cast steel is steel that has been melted in a "pot" and poured into a "mould" thus becoming an "ingot" which is afterward hammered or rolled to the size required. It may be of various "tempers," varying in percentage of carbon which they contain from three-quarters or less to one and a half or more.

THE TIME FOR STUDY.

Now is the season, says an exchange, the young mechanic should embrace to advance himself in the knowledge of his trade, whatever that may be. Autumn and winter are the seasons for study, and on no account should any young man who is learning any of the trades let the winter pass without improving his mind and gaining more knowledge concerning his trade than can usually be obtained in the workshop or on the building. It is the enterprising workman that first becomes foreman, then master builder. The young man who would rather loaf around the streets or "hang about" the corner store, seldom amounts to much. It is the studious, energetic fellow, in the building trades, as in every other occupation in life, that "gets the cake." A few hours each week spent in mastering the difficulties of a trade, is better than money invested, and is sure to bring in the very best of returns. Try it, young man. You will be none the worse for it, even if it is a failure.

SUPERHEATED STEAM.

A competent authority pronounces incorrect the current theory that superheating steam increases its pressure in pounds. It is asserted that if the steam is ordinarily dry, superheating to any temperature does not increase the temperature one ounce ; in steam engines steam superheated slightly is economical, in that it maintains its normal temperature longer ; that is, it does not condense so quickly, by reason of having a margin of heat above that due to its pressure, but highly superheated steam has disadvantages which are not counterbalanced. Again, it affects fibrous packings, decomposes lubricants, attacks working surfaces by drying them off so that they are apt to cut, and it has a special affinity for rusted surfaces, increasing and expediting the destruction of parts so affected most rapidly. From the instant that steam leaves the vessel in which it is generated, it commences to deteriorate in value by loss of heat : the farther it goes before reaching its work the more it loses. Superheated, it simply supports the vitality of steam and re-enforces it.

The Manitoba Board of Agriculture will send to Ottawa some of the Red Fife wheat and six rowed barley which carried off the Hudson's Bay Land Commissioner's prizes at the Provincial Exhibition. It will be planted on the central experimental farm, near Ottawa.

USEFUL INFORMATION

To remove grease from wall paper lay several folds of blotting paper on the spot and hold a hot iron near it until the grease is absorbed. Only a short time is required.

The curious observation that friction fails to produce heat in metals under the influence of magnets is now being discussed. Metals so exposed have been turned in a lathe quite cold.

JAPANNER'S GOLD SIZE.—Three quarts boiled oil, one pound litharge, one pound gum shellac, all boiled together till dissolved ; take off the fire, and add one quart turpentine. Strain off into a bottle.

TO GRIND BRASS VALVES.—In grinding brass valves do not use emery. The dust from a grindstone is much better and cheaper. It will not become embedded in the metal and cut ridges as emery will.

TO PRESERVE WROUGHT IRON FROM RUST.—A cheap method of preserving wrought iron from rust, after milling, is to first dip the article in hot soda water to cleanse from oil, then in hot lime water, and dry.

Potato is used to clean steel pens and generally acts as a pen-wiper. It removes all ink crust and gives a peculiarly smooth flow to the ink. Pass new pens two or three times through a gas flame, and then the ink will flow freely.

For a green transparent varnish for metals grind a small quantity of finely powdered chromate of potash (it requires the most elaborate grinding), add a sufficient quantity of copal varnish thinned with turpentine. The tone may be altered by adding more or less of one or the right ingredient.

The economy of an engine should always be rated by the amount of steam, or water, which it consumes per horse power per hour. The amount of coal burned per horse power per hour involves the economy of the whole plant, and is not a measure of the performance of the engine taken independently.

TO PROTECT BRASSWORK.—Yellow brass may be made to keep its color without appearing varnished, by means of a thin varnish of white shellac or a coating of collodion. It will retain its color for a long time without a protective coating of any kind, if the finish is sufficiently fine. A light film of gold is the best possible coating for fine brass work.

A DRY FIRE EXTINGUISHER.—A cheap and reliable dry extinguisher is recommended from Germany. Thoroughly mix fifty-nine parts powdered saltpetre, thirty-six parts powdered sulphur, four parts powdered charcoal and one part brown-red oxide of iron. When dry put up in pasteboard boxes with a fuse extending five or six inches both in and out of the box

Oak may be darkened by exposure to the fume of ammonia in a close box, but if the work is first oiled with linseed oil and wiped dry with a cotton or linen cloth, and then a solution of bichromate of potash (say half ounce of potash to one pint of water) be applied it will darken it, and not raise the grain, either of oak, mahogany and cherry. Care, however, must be taken that the work is not made too dark by too many applications of the solution.

POTATO MEERSCHAUM.—A new use has been discovered for potatoes. They can be converted into a substance resembling celluloid by peeling them and after soaking in water impregnating with eight parts of sulphuric acid, then drying and pressing between sheets of blotting paper. In France pipes are made of this substance scarcely distinguishable from meerschaum. By subjecting the mass to great pressure a substance can be made of it rivaling ivory in hardness.

PISTON VALVES FOR LOCOMOTIVES.—According to M. Ricour, piston valves in locomotives wear at the rate of one twenty-fifth inch for 125,000 miles, while with the slide valve the same extent of wear takes place with one-sixteenth of the mileage. The wear of the valve gear is reduced in the same proportion. The effect in the consumption of fuel is shown by the returns made at Saintes Station for the year 1882, where on all engines worked with slide valves the coal consumed per 1000 tons conveyed one mile was 226 pounds, against 234 pounds in the year 1884, when 30 out of the 40 locomotives had been fitted with cylindrical valves.

WOOD POWDER AS AN EXPLOSIVE.—Wood powder has recently been introduced as an explosive in the Belgian army in place of dynamite. The powder is obtained by treating ordinary sawdust with a mixture of nitric and sulphuric acids, which is afterward formed into cartridges by means of powerful presses. To protect these cartridges from moisture, they are afterward covered with paraffined paper. The instantaneous production of the gases arising upon explosion causes the air in contact with the face surface of the cartridge to act to some extent as a light tamping, and the power of the explosion is directed to the other face. In comparative experiments made with wood powder and dynamite, it was ascertained that, for equal weights, charges of the first substance were at least as powerful as those of the second, and the results were more regular.

PAPER PIANO CASES.—Accounts are given in the German technical journals of some interesting experiments which have been made with success in the employment of paper in piano construction. The case is made entirely of paper, as a substitute for wood, the material being so compressed as to be susceptible of the high polish which is required for such instruments. As described, the color is a creamy white ; the tone is reported to be characterized by sweetness rather than loudness, the sound emitted, unlike the short broke note of the ordinary piano, being soft, full and slightly continuous, somewhat resembling that of the organ. This modification of tone, which must be considered an attractive feature, is attributed to the evenness of texture of the compressed paper.