Machinery and Appliances.

THE GLOBE COMPOUND AUTOMATIC ENGINE.

MESSRS. JOHN MUSGRAVE AND SONS, LIMITED, BOLTON.

In many of our spinning, manufacturing, and finishing processes it often becomes necessary, or at least desirable, to work certain portions of the machinery apart from the other, or at times when the remainder is not working at all. In the latter case it is expensive to run the gearing and shafting of the whole place, it may be when only one machine is really required to be at work. Where this is a frequent liability, it becomes highly desirable, on the ground of economy, that the driving power should be divided and a certain portion have allotted to it an independent motor. In addition to these there are numberless cases in which proprietors of industrial and manufacturing establishments would be glad of the knowlege of a simple and efficient motor of wide adaptability, economical, not liable to get out of order, and which can be supplied of any degree of power that may be needed. We have pleasure in calling the attention of these to the Globe compound automatic engine, made by the firm whose name is given above.

This engine, of which Fig. 1 exhibits a front elevation, is of the single acting type, and consists essentially of one small or high pressure and one large or low pressure cylinder, placed side by side, and inverted over a pair of cranks set 180 deg. apart, with a valve chest and distributing valve arranged vertically between the two cylinders, forming an exceedingly simple compound engine, occupying little space even in the largest examples, and not liable to get out of order, owing to the fewness of its working parts, which are shewn in Fig. 2, representing a longitudinal section, and Fig. 3, which gives a section view through the high pressure cylinder. These shew the interior arrangements, from which the construction of the engine may be readily understood. The cylinders and valve chest are, in the larger sizes, cast in one piece, and bolted to the top of the crank case. In the smaller sizes, the crank case and cylinders are cast together. The cylinder heads cover the upper ends of the cylinder only, the lower ends opening directly into the crank case. The cylinder heads are provided with spring relief valves to allow of the escape of water, carried into the cylinders in starting, or from priming in the boilers after the engine is running ; and so prevent damage to the engine from this cause. The pistons are of the trunk form, and carry hardened steel wrist pins for the attachment of connecting rod. The connecting rods are of hammered steel of a rectangular section, and of ample strength to resist all strains that may come upon them. Both upper and lower bearings are lined with a special babbitt which has given the best of results in regular working. The cranks and shafts are all of steel, and run in babbitted bearings, two of which are in the heads of crank case, and the third is situated between the cranks.

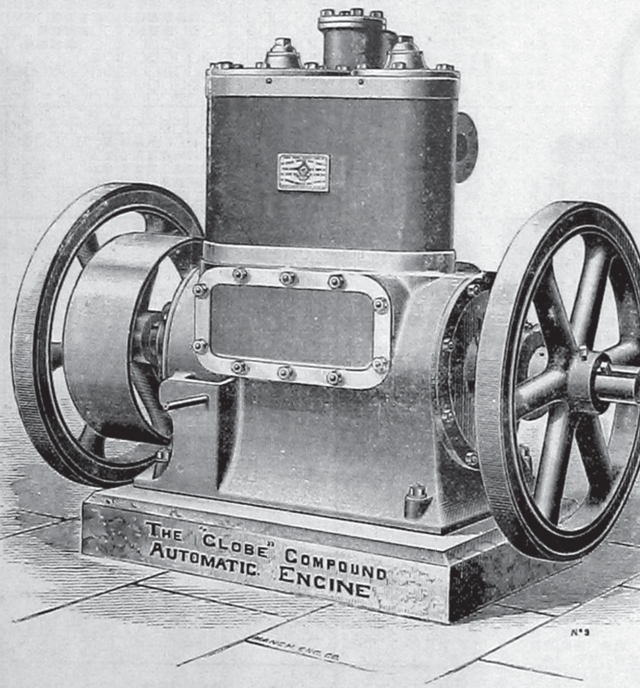


FIG. I.—FRONT ELEVATION OF ENGINE.

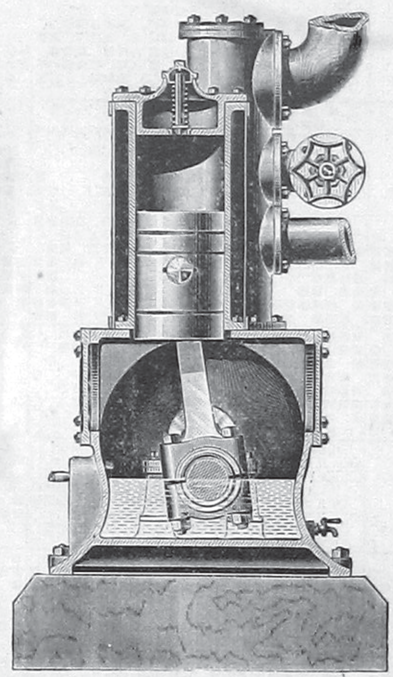


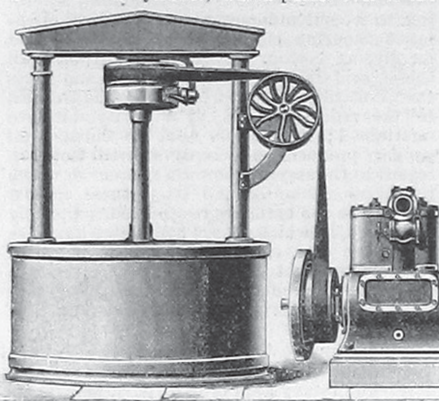
FIG 3.—SECTION THROUGH H.P. CYLINDER.

In order to meet all contingencies, facilities are provided for enabling the end bearings of the shaft to be readily removed for inspection without disturbing the shaft or the crank case heads. The side covers of crank case can be quickly removed, giving easy access to the whole interior of crank case, including cranks, connecting rods, eccentric and governor, and, if necessary, the whole of the working parts, including pistons, connecting rods, cranks, governor, eccentric and valve can be removed from a 100 h.p. engine in less than one hour. This will be appreciated by any proprietor of an establishment who has had experience of the delays and loss of time arising from the necessity of dismantling the older types of engines, in order to arrive at the seat of, perhaps, some trifling derangement.

This engine has been furnished with a piston valve of special design, which is not only balanced as regards steam pressure, but from method of construction is made absolutely tight, and the tendency is for it to remain tight instead of wearing loose and leaking after running a short time. An automatic governor is also supplied, which is situated in the crank case, between the two cranks, where all its working parts are constantly deluged with oil. This governor embraces some entirely new and distinctive features, among which are—that the parts subjected to centrifugal effort—*i.e.*, the governor weights and springs—are not affected by the reciprocating strains, and a much more even speed is maintained with less expenditure of force in the governor. The movement of the weights regulating the cut-off is conveyed to the main eccentric through a secondary eccentric, which relieves the weights of all strain imposed by the working of the valve, and allows them to take their true position, due to the speed, without reference to the effort required to move the valve and its connections, a point which, it is stated, no other governor possesses.

Perhaps the greatest novelty, however, is the fact that the crank case is constructed to hold a body of water and oil, and the cranks, connecting rods, eccentric, and governor pass through this oil at each revolution, giving a constant and thorough lubrication to all the working parts. A stream of oil and water also passes constantly over the main bearings, and is returned through suitable channels to the crank case, to be used over and over again. An overflow is provided for the escape of the excess of water, so the level in the crank case cannot get too high. This overflow is so constructed as to retain the oil and allow the water only to escape. Thus all the evils of intermittent and often neglected lubrication of the most vital parts are avoided, which will ensure a great prolongation of the usefulness and life of the engine, as will at once be obvious. The wearing parts of the engine are all easily and cheaply renewed, but as from the constant and copious lubrication the wear is very slight, the expenses of repairs are very low.

Having thus described the construction we may devote a short space to an examination of it at work. In operation steam is admitted by the valve to the top of the high pressure cylinder, pressing the piston down and turning the crank and its connections. As the piston moves downward, the valve, actuated by the governor, cuts off the admission of steam, and a portion of the stroke is made with expanding steam. Just before the high pressure piston reaches the bottom of its stroke, the valve opens communication between the high and low pressure cylinders, and, as the cranks are opposite, the low pressure piston is then at the top of its stroke, and is immediately pressed downward by the steam discharged from the high to the low pressure cylinder. As the low pressure piston moves down, the high pressure piston is moving up towards the top of its stroke, displacing the steam in its cylinder, which passes over to the low pressure side. When the stroke is partially completed, the valve cuts off communication between the two cylinders, and the steam remaining in the high-pressure cylinder is compressed, resisting the upward momentum of the piston, and bringing it gradually to rest at the top of its stroke, ready to commence the next downward stroke; meanwhile the low-pressure piston completes its downward stroke with expanding steam. Just before the low-pressure piston reaches the bottom of its stroke the valve opens communication with the atmosphere, if non-condensing, or with a condenser, if condensing. In the latter case the vacuum is immediately formed in the cylinder to start the piston on its upward stroke, relieving the crank pin of the work of lifting it. If no means were provided for counteracting the effect of the vacuum pulling the piston upward, the connecting rod would be lifted away from the crank pin, and a bad knock each stroke would result; but there is an annular space left below the large piston, so proportioned as to form, by the displacement of the piston itself, a vacuum sufficient to overcome the upward momentum of the piston, bringing it gradually to rest at the top of its stroke.



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WORKING HYDRO EXTRACTOR.

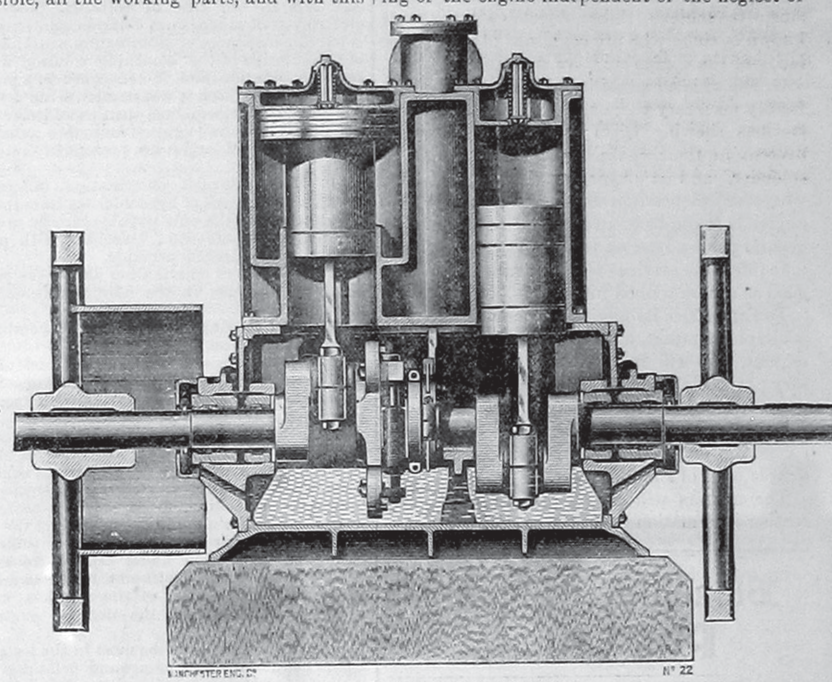
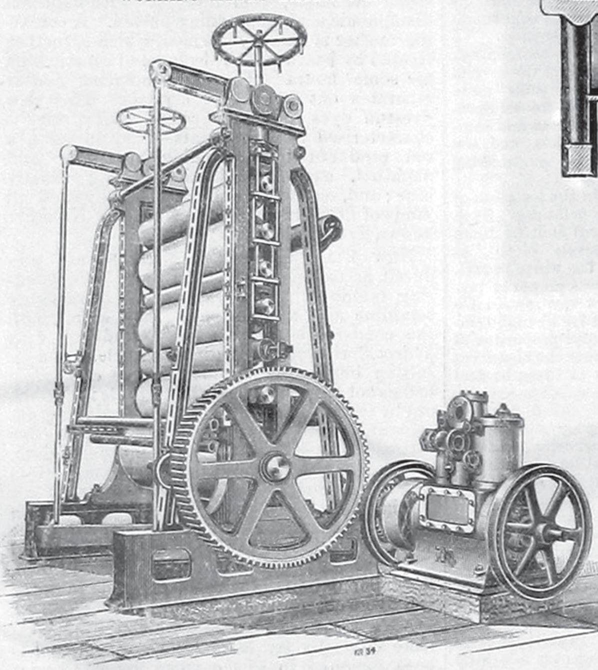
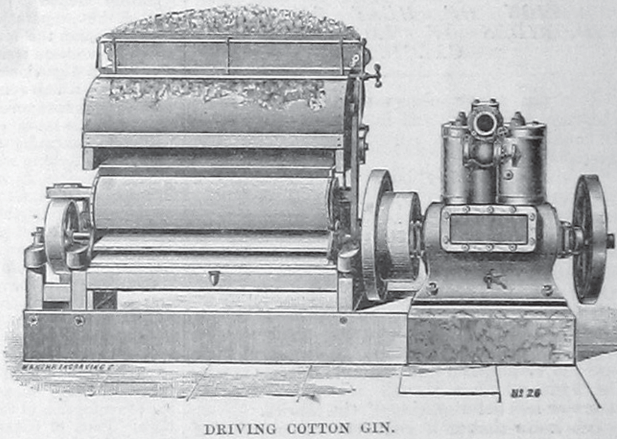


FIG 2.—LONGITUDINAL SECTION.



DRIVING CALENDERS DIRECT.



DRIVING COTTON GIN.

Great care has been taken to balance, as far as possible, all the working parts, and with this principle in view, the cranks have been placed exactly opposite each other, by which arrangement the reciprocating parts—*i.e.*, pistons and connecting rods—mutually balance each other, and so reduce the vibration that it is not noticeable, even when running at very high speeds.

A very nice adjustment of the governing has been obtained. When the governor is correctly set it will not commence to operate until the engine is running within one per cent. of its regular speed, and will pass over its entire range of movement before the engine is running one per cent. too fast. This is a total variation of less than two per cent., and means that when an engine is speeded to run 300 revs. per minute under load, it will not run faster than 304 or 305 when doing nothing, or slower than 300 or 299 when fully loaded. These are the speeds to which they are adjusted in the works, and are constantly verified in their regular working.

In designing this engine the makers have had the following objective points in view:—To make a compound engine whose simplicity would commend itself to all engineers and purchasers. To attain the highest grade of economy possible with a compound engine, and size for size of engine to surpass all competitors in economical results. To render the good working of the engine independent of the neglect of a careless and unskilled attendant. To reduce the wear to a minimum, and to make the good performance of the engine independent of wear, and from this feature long continuous runs of from one month to one year's duration are readily attained. To lessen the requirements and expense of repairs either in time or money, by making the parts liable to wear of simple construction, easy to renew, maintaining the engine *new* in all its essential respects, even after long continuous use. To run the engine at a fair rate of speed, or even a high speed if desired, without impairing its economy, its running qualities, or abridging its lifetime. To thoroughly protect all the working parts from dust and dirt, render the oiling of all joints and bearings constant and copious, and reduce the amount of attention required when running, so that one attendant may look after a number of engines. To keep the strains constant in one direction, so that should wear take place it will not affect the running qualities of the engine, or to make the disagreeable pound or knock so often heard in double-acting engines, and to place a high grade compound automatic engine on the market at a moderate price by systematic manufacture on a large scale, without reference to orders. That Messrs. Musgrave and Sons have, with the introduction of this engine, done much to achieve these objects will be well known to those who are cognisant of the popularity of the engine we have described.

Of the wide adaptability of these engines it is hardly necessary to speak; we give three illustrations shewing them operating machines so diverse in their character as a cotton gin, a calender, and a hydro-extractor. In fact, wherever independent driving is desirable this engine is found to be invaluable, and where for general use a power up to 3 to 400 horse-power is required its services will be available, and as good as can be wished for.

To summarise its merits, we may say that it is simple, compact, and durable; it runs at a regular, and will run at a high speed if necessary; it costs scarcely anything for erection, very little for a foundation; it requires little attention, and its first cost is less than other compound engines, and, in many cases, less than simple ones of similar power.

The makers will be pleased to afford any further information that may be desired.

Bleaching, Dyeing, Printing, etc.

ACTION OF HEAT ON THE CHLORIDES OF MAGNESIUM AND CALCIUM.

It is not a new observation that when the chlorides of calcium and magnesium are heated in contact with air a portion of the chlorine is given off.

In view of the very large quantities of both these substances used in the sizing and finishing of cotton and other goods, it is evidently of considerable interest and importance to define at what temperature, at how low a temperature in fact, and to what extent, the decomposition of these salts proceeds, because if the chlorine be liberated at temperatures to which it is at all likely that the fabric containing them may be subjected under the ordinary conditions of their use and manufacture, then the chlorine or resulting hydrochloric acid will be certain to cause more or less deterioration of the fabrics.

We know that at a red heat the chloride of calcium becomes alkaline to litmus, and that at temperatures considerably lower than this the chloride of magnesium parts with an appreciable amount of its chlorine. Recently several cases of deterioration of the strength of cotton fabrics have been traced to the action of chloride of magnesium, and we may take it as an undoubted fact that the tendering of the cotton fibre in such fabrics is due to the action of the hydrochloric acid formed by the decomposition of the chloride. Mr. H. Grimshaw has recently made some experiments on this point, and he finds that at a temperature of 150° C., magnesium chloride was decomposed, while at 117° C. it was unaltered. Chloride of calcium was not affected at a temperature of 165° C.

These results would shew that chloride of calcium is far preferable to chloride of magnesium as a finishing agent.

THE CHEMISTRY OF HYPOCHLORITE BLEACHING.

In a paper recently read before the Society of Chemical Industry, Messrs. Cross and Bevan communicated some valuable notes on this subject. They give the following summary of their results :—

(*a*) Bleaching by means of the hypochlorites is attended with chlorination of the fibre constituents, more or less, according to the nature of the basic constituent of the bleaching solution and the condition of the fibre substance.

(*b*) The chlorination is conspicuously less in the case of magnesium hypochlorite—prepared by double decomposition from bleaching powder—and still less in the case of solutions prepared by electrolysis of magnesium chloride solutions.

(*c*) The evidences of chlorination are (1) a portion of the chlorine of the bleaching solution does not revert to chloride, and, in consequence, a portion of the base with which it was combined as hypochlorite is otherwise combined than as chloride in the exhausted mixture (solution and fibre substance); (2) "organic" chlorides are present in the washed pulp.

(*d*) The factor of chlorination differentiates bleaching by means of hypochlorites from those processes in which the only possible factors are oxidation and hydrolysis—*e.g.*, bleaching with permanganates and hydrogen peroxide.

(*e*) The cause of chlorination lies in the presence of ketonic oxygen in the fibre constituents (non-cellulose).

Also the following points of practical rather than theoretical interest :—

(*f*) The simple and accurate method of determining the "free base" in hypochlorite solutions, by direct titration after destroying the hypochlorite by means of hydrogen peroxide.

(*g*) As a result of such determinations, that the proportion of free base to hypochlorite, in solutions made from bleaching powder at various concentrations, varies inversely with the concentration.

(*h*) That bleaching, to be efficient, economical, and safe, requires a careful regulation of the several factors; these are translated from their more theoretical expression under (*d*), nature and proportion of the basic constituent, both free and combined; the temperature of the solution, and the nature (composition) of the negative or oxidising constituents.

Bleaching consists for the most in the isolation of a pure cellulose from a compound cellulose. Such is the cotton bleach (cloth and yarn) and the linen "bottom bleach" (almost exclusively cloth), as well as the preparation of pulps for white papers. In these cases the bleaching process proper is preceded by a severe treatment of the raw material—generally a digestion with alkaline lye at high temperatures—which removes the greater proportion of the non-cellulose constituents, leaving the bleaching solution little more than residues of these to deal with. In contradistinction to these, there are the kinds of bleaching which are well called "whitewash" bleaches, in which the purpose is to whiten, as far as possible, a compound called cellulose itself, by removing colouring matters, either adventitious (*e.g.* chlorphyll and proteid residues) or products of change of the fibre substance. In such bleaches the purpose is to resolve the compound cellulose as little as possible, for resolution means loss of weight, and in cases where the fibre is made up of units of microscopic length—as in jute, with an ultimate fibre of $\frac{1}{25}$ to $\frac{3}{25}$ inch—serious loss of strength. To this category, as well as jute, the various treatments of linen yarn known as "creaming," "half," and "three quarters" bleaching belong. In all these cases the consumption of the bleaching agent is relatively high. This, of course, immediately follows from the more oxidisable character of the non-cellulose constituents of fibres.

Dyeing Wool Tops.—Mr. Sam Mason, Jun., of Manchester, has recently patented an improved machine for dyeing wool tops. It consists of a vertical kier, resembling in appearance a bleaching kier, which can be hermetically closed. In this, above a perforated false bottom, are arranged four perforated pipes, on which the wool tops are placed. These four pipes all unite at the bottom into one common pipe, connected on one hand with a suction pump, by means of which any liquor in the kier can be forced up into a liquor tank above the kier, and on the other hand with a pipe leading direct to this liquor tank. Other pipes are arranged in connection with the kier, so that it can be worked very conveniently in a variety of ways. The new dyeing kier is used thus :—The liquor tank is filled with the dye liquor, all valves being closed, the wool tops are put on the perforated pipes, and the kier is closed; the suction pump is set in action, whereby all air is drawn out of the wool; then the valve from the liquor tank is opened; the liquor rushes in and fills the kier; it is drawn out by the suction pump back into the liquor tanks, from whence it again passes into the kier. Thus there is a constant circulation of the dye liquor through the wool tops, which is continued until the dyeing is complete. Then the dye liquor can be replaced by wash waters, and the wool tops washed, and then they are ready for taking out.

Hydroleine.—This is the name that, according to a contemporary, is given to one of the latest colouring matters placed on the market for dyeing cotton. By using 2 per cent. of acetic acid it is soluble in water, and dyes tannin-mordanted cotton blues from the greenest to the reddest shades, of a purity hitherto unattained; while it is said to surpass all similar products previously offered both in regard to the easy and uniform manner in which it goes upon the fibre and its fastness against soap. The dye baths are readily and completely exhausted, in which respect hydroleine has some advantage over other blues. What is called Hydroleine Night Blue is distinguished even in the lightest and most delicate tones by its perfectly pure tint of greenish blue even by daylight.

A new red colouring matter, which will dye animal as well as unmordanted vegetable fibres, and in any kind of bath, acid, neutral, or alkaline, has been patented by Messrs. Casella and Co. This new dyestuff is made by diazotising benzidine, combining it with naphthol disulphonic acid, and adding phenol. A colouring matter is thereby formed, which is further treated by heating with alcohol and caustic soda for some hours. The new colouring matter separates out in shining crystals. This new dyestuff dyes beautiful scarlet shades, and is characterised by two points—first, in being a red produced by combining benzidine and naphthol, such combinations being usually blue; and, secondly, in dyeing equally well all kinds of fibres in all kinds of baths. No other known dyestuff has this property.

New Blue Colouring Matters are produced, according to a recent patent, by condensing tannin with aniline, or its homologues toluidine and xylidine, and then acting with the condensation products so produced with hydrochloride of nitrosodimethylanile. The resulting blue colouring matters are crystalline bodies not soluble in water but soluble in alcohol, but by treatment with bisulphite of soda they are converted into soluble products, which dye cotton, that has been treated with tannin, alum, or chrome mordants, shades varying from a brilliant blue to blue violet, while they can also be used for painting calico with either an alum or chrome mordant. By sulphonating the colouring matter instead of treating with bisulphite of soda, sulpho colour acids are formed, the ammonia salts of which are soluble in water and dye wool in the usual acid bath.

A New Dyeing Machine, which is applicable more especially for loose wool and yarns, has been patented in this country by M. Charles Vandermeirssche. The machine consists essentially of a dye-beck containing the dyeing liquor, and in this are placed a number of pots, cylindrical in shape, and fitted with perforated tops and bottoms. A number of these pots are arranged in horizontal series, and they are so constructed that they can be made to revolve on an horizontal axis common to this series, and passing through the middle of the length of each pot. The rotary motion, is, however, not continuous, but intermittent, the period of rest being arranged so that the pots are in a vertical position. Above each pot is arranged a cover with a pipe, which is in communication with the liquor in the tank. During the periods of rest this cover descends on and hermetically fits the pot, and by means of a suction pump the dye liquor is forced through the pots for a short time; then the cover is made to rise, and the pots begin to rotate again. These operations