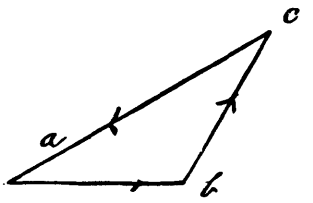
Moreover we have that in the following Fig. 5, if A E be drawn equal and opposite to A D, the three forces A B, A C and A E will balance each other. But these are correctly represented in magnitude and direction by the successive side *a b*, *b c* of the triangle *a b c* (Fig. 0) drawn parallel to (in the same direction as) the forces A B, A C and A E.



— Fig 6 —

Hence follows the proposition called the

TRIANGLE OF FORCES.

that is,—if three forces be represented in magnitude and direction by the three sides of a triangle taken in order, these three forces will balance each other when applied at the same point.

For the CANADIAN MAGAZINE OF SCIENCE.]

NEW PROCESS FOR THE MANUFACTURE OF CHLOROFORM.

J. H. B.

A new process for the manufacture of chloroform has just been patented in the United States. It has caused quite a revolution in the trade, and bids fair to place the manufacture of the total annual consumption in the United States, which may be estimated as 300,000 lbs., in the hands of the patentee. Although a number of large firms have been working to obtain the same end, viz., the cheap production of chloroform, it has been the good fortune of a gentleman of Albany, to perfect the process, and he will thus reap a large pecuniary reward as the result of much labour and patience.

The invention is based upon the discovery that when a crude Acetate, as of lime, is subjected to dry distillation, only very small quantities of Acetone ($C H_3 CO C H_3$) are produced, while considerable quantities of

Dimithylacetal .	$C_2 H_2 (OCH_3)_2$
Ethylmethylacetal .	$C_2 H_4 (OC_2 H_5) OCH_3$
Methyldimithylketone .	$(CH_3 CO. CH_2 CH_3)$
Methylethylketone .	$(CH_3 COC_2 H_5)$
Diethylketone .	$(C_2H_5 CO C_2 H_5)$
Metacetone .	$(C_6 H_{10} O)$

and other still higher boiling ketones, as dumasin, are the result of the process.

The second part of the invention is based upon the discovery that while pure acetone, when distilled with a hypochlorite, yields only 33%, the above-mentioned ketones, which possess higher boiling points than does acetone, will yield chloroform when freed from water and distilled with a hypochlorite, as above, in the proportion of measure for measure when we consider it deprived of its water, as a basis of comparison.

In practical working of the invention, say a hundred pounds of crude acetate of lime is taken and subjected to distillation in a suitable vessel, at a temperature of 300° to 500° Centigrade, until volatile products are no longer condensed. The result is then about 32 lbs. of liquid, consisting of an aqueous fluid with an oily stratum floating upon it, the proportions of the former to the latter being as 4 to 1. The aqueous solution is removed and the oily one washed with tepid water and added to it. Acetic acid or acetates may be easily recovered from the residue of distillation, and the acetic acid produced varies from 20% to 25% according to the temperature employed.

In order to obtain crude chloroform from the above distillate, 9 lbs. of it is taken and mixed with 40 lbs. hypochlorite of lime (or other suitable hypochlorite) and about 15 gallons of water, and subjected to distillation in the usual manner. The result, amounting to 4½ lbs., will be found to vary in specific gravity from 1.465 to 1.475, and may be rectified in usual manner.

THE "OHIO" WELL DRILLING MACHINE.

The "Ohio" Well Drilling and Prospecting Machine seems to be the latest novelty in that line. Its advantages being in its quick motion in handling the tools, and in being positively self-cleaning as the work progresses. The remarkable ease with which the machine is operated, and the steadiness of the motion when working heavy tools, are also some of the desirable features claimed for it. It is said to work where all others drills fail, and to allow of the easy determination of the coal or mineral vein when prospecting. The work of the machine is all done by drilling with a lift and drop motion to the tools.

The drill is a compound chisel bit, reamer and sand pump, and is connected to a hollow drill stock which reaches to the top of the well, and which is arranged so that the cuttings of the drill are discharged with considerable force from the end of the rubber hose which is connected to the top of the drill stock by a nonleaking swivel joint. The tools are lifted by being grasped by the concave jaws which are carried up and down very rapidly by the cross head and guide. When the jaws reach the proper height they release the tools and they drop freshly, only to be picked up and dropped again at each revolution of the crank wheel. From 70 to 90 drops of the drill each minute is the usual speed, and there is absolutely no back-lash or jerk on the machine or power when the tools drop. One horse can drill wells from 250 to 300 feet deep operating a set of tools that weigh from 800 to 1,000 pounds, while for greater depths, where two horses are used, a set of tools weighing more than the combined weight of the machine horse power and derrick, can be easily operated. In using this drill the tools need not be taken out of the well so long as the earth does not cave or it becomes necessary to put in the tubing, but the cuttings of the drill are carried up the hollow drill stocks and are discharged from the rubber hose at each stroke of the tools, as shown in the cut. The same drill, etc., used in earth work, is also used in drilling rock, and in material of this kind the tools are only drawn out of the hole when it becomes necessary to dress the drill.

When a vein of water is struck or tapped by the drill, it can be easily tested with the tools before they are removed from the well.—*Chic. Jour. of Com.*

London increases its population by 46,000 every year. It has 1,900 ships and 10,000 sailors in its port every day. Its beer shops and liquor saloons would, if placed side by side, form a row seventy-eight miles long. Thirty-eight thousand drunkards are brought before its magistrates every year, and every Sunday seventy miles of open shops invite the purchaser to enter.