rope, six miles in length, has been sent to Java. It is noteworthy that these wires also make good flexible pipes for water supply, etc. The first three wires of this type have been placed, this spring, in a lake near Amsterdam. The laying is very quickly accomplished. The process only is indicated. Over a lead pipe, about 2in. in diameter, ⅙in. thick, an impregnated texture is first applied, and this then wound with ¼ in. "fasson" wires. An outer layer of cloth, held by galvanised wires, is then added, merely as a protection against rusting. The finished pipe would have a diameter of 82 millimetres, 3·23in., weigh 20 kilogrammes per metre, and cost 16 mark—rather a high price. But such pipes may indeed be very convenient for carrying pipe conduits for water, oil, etc., across marshes and rivers.

The Thwaite-Gardner system of utilizing blast-furnace gases is reported now to be receiving much recognition and approval both in England and Scotland, and that many firms are considering the propriety of adopting it. Some installations have already been settled. With a production of, say, 1,300 tons of pig iron per week, requiring, say, 32 cwt. of coal per ton of pig, it is estimated that if one-third of the gases are employed for heating blast, there should be available with the new system some 14,000 horse power, instead of 3,000 horse power with steam boilers, thus leaving a large balance of power in favour of the Thwaite-Gardner system.

Major Walsh, of Brockville, Ont., recently appointed by the Dominion Government, Administrator of the Yukon Territory, whose portrait we have pleasure in reproducing in our illustrated supplement this month, served for many years in the North-West Mounted Police, where he rendered distinguished service in the field. Major Walsh is eminently qualified for the position, and his appointment has given the greatest satisfaction. Since leaving the force Major Walsh has been connected with the coal trade, being associated with the well-known house of Bell, Lewis and Yates. He was also identified with the development of the Souris coal fields, in southern Manitoba.

Notes on Conveying-Belts and Their Use.*

By Thomas Robins, Jr., New York.

About six years ago the writer had occasion to visit a large magnetic iron-ore concentrating-plant, and then saw for the first time rubber belts being used for conveying purposes. These belts were from 20 inches to 30 inches in width, and some of them were as long as 500 feet between centres. When I spoke of the enormous amount of material they handled with a small expenditure of power, the superintendent assented, but at the same time complained that although he bought the best quality of belts, the abrasion of the ore wore them out very rapidly, causing continually very large bills for repairs and renewals.

On close examination several interesting points were discovered:

1. It was noticed that the thin layer of rubber which covered the belt resisted the abrasion much longer than did a corresponding thickness of the cotton duck which formed the body of the belt; in fact, the life of the cover represented about one-half the life of the belt, although forming less than one-fifth of the total thickness.

2. Each layer or ply of duck wore out more quickly than the one preceding it, showing that the fibres were cut more easily when under tension, and, of course, the tension on each fibre increased as the number of fibres bearing the tensile strain diminished.

3. The wear was greatest in a line along the centre of the belt. Frequently this part would be so quickly destroyed as to cause the belt to split in two longitudinally, though at the same time the portion nearer the edges was almost as good as new.

Noticing these facts it became obvious that the functions of the cotton duck should be solely to give the belt tensile strength, and that it ought to be so protected by some abrasion-resisting cover that it would not be injured by contact with the material conveyed. It is also evident that this protecting cover ought to be of extra thickness over the centre of the belt, in order to stand the harder work forced upon that part. Being engaged then, as now, in rubber manufacture, it was a simple matter to make a belt with a heavy rubber covering on the carrying side, and thicker in the centre than at the edges.

This reinforced cover renders the resistance to wear equal in all parts of the belt, and although being merely the anticipation of a patch, like the brass toe-cap on the school-boy's shoe, or the two-ply seat in his trousers, it was, like them, deemed patentable.

The ideal conveying-belt would be like the celebrated "one hoss shay," which disintegrated so evenly and completely when its work was done that there was nothing left to repair or regret.

Wishing to ascertain what particular compound of rubber would make the most durable carrying-surface, I made a lot of small samples, each mixed differently, and exposed them to a very powerful sand-blast, which in its effect approximated the conditions to which the compound would be subjected in actual use, but it was more convenient for a large number of tests, being much quicker. The result of the first series of experiments indicated what grades of gum and what adulterants had better be left out, and also showed something that was very gratifying, namely, that there were certain adulterants which could be used in sufficient quantities to bring the cost down to a reasonable figure. I then made a second set of samples, following in the mixture the formula used in the more successful ones of the first set, but each new one was an attempt to improve upon its prototype. Some of the samples, owing to more intelligent methods in mixing them, proved so durable that that the sand-blast test became too tedious, and a more severe and expeditious one was needed. This was found in exposing a disc of the rubber 6 inches in diameter by ⅛ of an inch thick to a heavy falling stream of crushed ore. The ore averaged about ¾ of an inch in size, and was delivered in a compact and heavy stream from the end of a very fast moving belt. The sample was so fastened to a board as to receive the whole stream of ore, and immediately deflect it. In this way the rubber came in cantact with 200 tons of ore per hour, of which each fragment was delivered with considerable force full upon it. At first it was easy to see the comparative loss of weight, after the sample had been exposed to the ore for an hour or two. In the next series results were very apparent after a day's run, but later, as results were developed which I was willing to accept as final, it became necessary to weigh each disc before and after the exposure, and thus learn the percentage of loss. The figures relating to the last set of compounds are as follows:

Samples.	Weight Before Test. In Grammes.	Weight After Test.	Percentage of Loss.
No. 154	103	102.7	.0029
No. 155	140	138.9	.0078
No. 156	134.7	132	.0164
No. 157	116.7	113.8	.0257

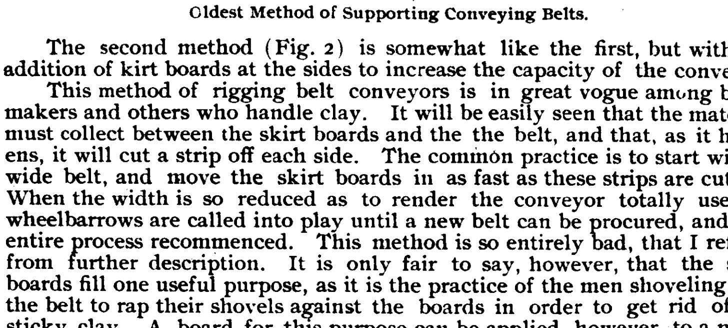
The test lasted for 12 hours' steady running under the conditions stated above.

Having at last decided upon the proper compound for the carrying surface, I applied it to the belts, and I may say that every belt made since that time, which was in 1892, is in good order to-day. In many cases, too, the belts which they replaced had been completely destroyed in three months' time under exactly similar conditions.

There are four principal methods of supporting conveying belts.

First we will consider the oldest method, in which the belt lies flat upon a straight faced, horizontal pulley, as shown in cross section, Fig 1. On account of the liability of the material to roll off the belt, this form is only suitable under certain conditions. The belt cannot be heavily loaded, and the feed must be so regulated that an even amount may be delivered to the belt at all times. If the material is below ¼-inch in size, the speed may be as high as 300 feet per minute. In carrying larger stuff on flat belts the speed must be lower; but the most necessary thing is to keep the belt very tight, that the material may not be jarred off in passing over the idler pulleys. This, of course, increases the strain on the bearings, and from that fact, together with their low efficiency compared with systems to be described later, we may consider flat running belts as being out of date.

Fig. 1.



Oldest Method of Supporting Conveying Belts.

The second method (Fig. 2) is somewhat like the first, but with the addition of kirt boards at the sides to increase the capacity of the conveyor.

This method of rigging belt conveyors is in great vogue among brick makers and others who handle clay. It will be easily seen that the material must collect between the skirt boards and the belt, and that, as it hardens, it will cut a strip off each side. The common practice is to start with a wide belt, and move the skirt boards in as fast as these strips are cut off. When the width is so reduced as to render the conveyor totally useless, wheelbarrows are called into play until a new belt can be procured, and the entire process recommenced. This method is so entirely bad, that I refrain from further description. It is only fair to say, however, that the skirt boards fill one useful purpose, as it is the practice of the men shoveling into the belt to rap their shovels against the boards in order to get rid of the sticky clay. A board for this purpose can be applied, however, to a much better form of conveyor, and in such a way that it cannot interfere with the belt. (See Fig. 5.)

The third method is a slight improvement upon the last, in that a trough is made by raising the sides of the belt instead of using boards as described above. The conical pulleys used for this purpose are shown in Fig 3.

* Paper read before the Am. Inst. of M. E.