LABOUR-SAVING DEVICES (FACTORY)

Four years ago a report and a paper on "Labour-Saving and Cost-Saving Devices" and "Labour-Saving Devices" (Factory) respectively were read before this Association at the Annual Congress, and as the above subject is a very important one, your Council considered that a further contribution be undertaken and with this object in view a Committee was formed to investigate the matter.

This subject has been exercising the minds of all executive staffs in the sugar industry for some time past and they fully realise what is involved and that no great degree of imagination or vision is required to gain some picture of what the future is likely to be, especially with the trend of world affairs as it is to-day.

In this country, where great industrial development is taking place and is likely to continue for some time to come, it is imperative for the sugar industry to concentrate and seriously investigate this matter of paramount importance.

The ever-increasing cost of plant, materials, manufacturing requisites and labour, make it more than ever essential that every avenue should be explored to reduce these costs wherever possible, particularly the latter, as the labour payroll has advanced enormously during the past three years; and especially if the industry wishes to continue to be of substantial economical structure in this country, and eventually if necessary to meet competition from other sugar producing countries in the world.

There is a shortage of sugar throughout the world to-day, but as reconstruction progresses this deficit will undoubtedly turn to a surplus and there is no time to lose. Act immediately, not only keep abreast of the times but keep ahead of them.

The Committee issued a questionnaire to all 18 factories—the response was fairly good. Twelve replies were received. If the Committee is to investigate this matter further there must be one hundred per cent. replies and more details must be given of the plant installed.

Apart from the installation of plants in the high cost category with possibly one or two exceptions, it is surprising to note from the information available that there appears to be very little achieved generally on labour-saving devices during the past three years. The information has been summarised, but unfortunately it has not been detailed enough to be of any great assistance, as in many instances items of plant have been given under a heading only. Therefore, it has been difficult for the Committee to give descriptive details of all the plant installed and they have come to the conclusion that to make a comprehensive report, a survey by some individual who could give his undivided attention to the subject and visit each factory to collect all the details required to compile a report of labour-saving devices, would be more satisfactory. Or failing this, some arrangement must be instituted whereby an exchange of view on modifications and savings affected can be circularised or conveyed to all concerns on the lines of the quarterly meetings inaugurated two years ago when members of the technical staffs of factories gathered at various centres for the purpose of discussing manufacturing problems. However, an endeavour has been made to submit a report of the information received.

The report is sub-divided under six headings, namely

1. Simple appliances at low cost.
2. Plant of moderate and high cost.
3. Re-arrangement of plant.
4. Labour-saving in chemical control.
5. Cost of labour units.

1. Simple Appliances at Low Cost.

There are many small effective devices which can be adopted at low cost and they are the means of reducing a unit of labour at various stations, i.e. central control of mill engines by extending valve spindles to mill platforms, with push button speed control, through v.i.p. gears as part of governor equipment. Similar control can be applied to pump stations. Indicator floats for liquor level in tanks can be used. Ball float control can be used in many instances, especially where tanks or receptacles are to be filled to predetermined levels and in this connection re-arrangement of discharge pipes with the valve control centralized. The introduction of remote control for various duties should be investigated as there is a possibility of utilizing this application in many directions. Further, the use of reflecting mirrors could with benefit be used in some instances. A number of these items mentioned above would only cost from a few pounds to not more than £50, and with a little initiative and ingenuity could be made to operate very effectively.

2. Plant of Moderate and High Cost.

There are throughout the factory many departments where fairly numerous units of labour are used which, under existing conditions and layout, are necessary to control such plant. Investigations would probably prove that by the installation of moderately-priced machines and new plant, labour units could be reduced considerably.
A typical example was received of where at a low cost, i.e. £2,160, forty-seven labour units were saved and the plant installed was as follows.

<table>
<thead>
<tr>
<th>Cost</th>
<th>Units saved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-Bagging Machines</td>
<td>£300 6</td>
</tr>
<tr>
<td>Maxwell Boulogne Automatic Water Scales</td>
<td>700 3</td>
</tr>
<tr>
<td>Tractor for Shunting (Yard)</td>
<td>600 6</td>
</tr>
<tr>
<td>CO₂ Plant and Lime Plant</td>
<td>60 3</td>
</tr>
<tr>
<td>Re-arrangement Juice Pumps and Scales</td>
<td>100 3</td>
</tr>
<tr>
<td>Lime Handling Plant</td>
<td>200 5</td>
</tr>
<tr>
<td>Filter Press Scum</td>
<td>200 21</td>
</tr>
</tbody>
</table>

£2,160 47

Equivalent to £46 per unit saved—-a very creditable performance.

Plant of high cost such as Oliver Campbell filters, Bach subsiders, boilers of modern design, high speed centrifugals, etc., are of high cost and incidentally are instrumental in reducing labour, but at a much higher figure per unit of labour saved than the lower priced equipment already mentioned previously.

The installation of such plant is not always exclusively termed labour-saving appliances and are associated generally with improved manufacturing technique. The combination of the two, however, has brought about very beneficial results. Two examples were revealed in the returns recently received, namely:

<table>
<thead>
<tr>
<th>Cost</th>
<th>Units saved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two Oliver Campbell Filters</td>
<td>£12,779 30</td>
</tr>
<tr>
<td>Two Bach Subsiders</td>
<td>9,000 15</td>
</tr>
</tbody>
</table>

£21,779 45

Approximately £480 per unit saved.

The other example

<table>
<thead>
<tr>
<th>Cost</th>
<th>Units saved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three Bach Subsiders</td>
<td>£15,000 21</td>
</tr>
<tr>
<td>Eight 40 in. H.S. Centrifugals</td>
<td>26,000 24</td>
</tr>
</tbody>
</table>

£41,000 45

Approximately £910 per unit saved.

3. Re-arrangement of Plant.

Quite a number of labour units could be dispensed with if re-arrangement of plant was considered. This is a matter that should be investigated further; unfortunately in the past the question of additions to meet increasing capacities has not been provided for, and with the low cost of labour in past years, this point has not been given the consideration and attention it should have received, especially in factories of comparatively recent standing, namely twenty to twenty-five years. Of course, some factories have been in existence since 1879 and even earlier, and in these cases it has been very difficult to provide the most suitable layout owing to restricted space and time during off-season recess. In future more attention must be given to this point and when new plant of any proportions is installed the general arrangement of same should be linked up with the existing plant in such a way that the question of labour-saving must be given every consideration.

In many instances it will now be a major problem for some factories to re-arrange plant without fairly extensive heavy expenditure but a programme of alterations and additions with the object of reducing labour could be undertaken over several years.

4. Labour-Saving in Chemical Control.

The question of labour-saving in chemical control depends primarily on sampling, the preservation of materials not required for continuous hourly control and the locality of the laboratory in relation to the factory.

In sugar work, not only must a sample be representative of the whole, but there is the constant fear of deterioration of primary dilute products. Sampling devices control the first, but often accentuate the second. This is overcome by hourly analyses or by preservation. Refrigeration and preservatives have been tried with uncertain results.

The only positive way in which labour may be saved is by the centralization of the laboratory inside or close to the factory, whereby certain materials may be continuously sampled by pipes, etc. The whole question is complex and controversial and the importance of accurate chemical control cannot be over-emphasised, both from a monetary and control point of view. There is indeed a distinct danger in saving a few units of labour and losing accuracy, which is the first principle of chemical control.

Further work might be done on the preservation of such samples as are not essential for efficient control, thereby lessening the tendency towards multiplicity of unnecessary figures.

5. Cost of Labour Units.

The cost of each unit of labour as laid down in Determination No. 98 and the amendments thereto is as follows

Grade 1 | £3 1 2 per week
Grade 2 | £2 9 5 per week
Grade 3 (labourer) | £1 14 3 per week

The above figures include hospitalisation, housing, cost of living, insurance, etc.
Of the total labour strength of one large factory turning out 68,000 to 70,000 tons sugar per season, the proportion of grade workers is as follows.

Grade 1 ... ... ... ... ... ... 3.96 per cent.
Grade 2 ... ... ... ... ... ... 47.58 per cent.
Grade 3 ... ... ... ... ... ... 45.37 per cent.

The balance is accounted for in crane drivers, store attendants, timekeepers, etc. Reducing these units to a cost structure can principally be confined to the two latter grades, i.e. 2 and 3.

The figures as set out below will give some indication as to what a reduction in cost of these two groups would amount to.

### Grade 2.

<table>
<thead>
<tr>
<th>Units saved per month</th>
<th>Total £</th>
<th>Over 6 months £</th>
<th>Based on 5,000 tons Sugar £</th>
<th>On crop of 30,000 tons Sugar £</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>107</td>
<td>642</td>
<td>5d. 625</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>214</td>
<td>1,284</td>
<td>10d. 1,250</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>321</td>
<td>1,926</td>
<td>1/3 1,875</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>428</td>
<td>2,569</td>
<td>1/8 2,500</td>
<td></td>
</tr>
</tbody>
</table>

### Grade 3.

<table>
<thead>
<tr>
<th>Units saved per month</th>
<th>Total £</th>
<th>Over 6 months £</th>
<th>Based on 5,000 tons Sugar £</th>
<th>On crop of 30,000 tons Sugar £</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>74</td>
<td>445</td>
<td>3/4d. 437</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>148</td>
<td>890</td>
<td>7d. 874</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>222</td>
<td>1,335</td>
<td>10/4d. 1,311</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>296</td>
<td>1,781</td>
<td>1/2 1,748</td>
<td></td>
</tr>
</tbody>
</table>

All the figures quoted above are approximate in as much that the shillings and pence have been deleted.

From the foregoing figures it will be observed that the greatest saving can be effected on Grade 2 units, as these individuals are paid 45 per cent. more than the Grade 3 units. Therefore the only means of reducing the number of units in this Grade is by labour-saving appliances. Of course, this also applies to Grade 3 but not to the same extent; as these units perform the majority of duties where it is difficult to devise appliances to replace them, such as stacking sugar pockets in the store and S.A.R. trucks, off-loading of merchandise of all descriptions, general cleaning and the several multiple duties necessary in and around a sugar factory.


The method of how best to tackle the problem of reducing labour units, is in the opinion of the Committee, to have a general survey of the whole labour complement in the factory, and see where the largest number of units is employed in each department and then devise ways and means by employing the following methods:—re-arrangement of plant, introduction of mechanical handling devices or re-arrangement of duties of the units—this latter course was adopted in one factory together with minor alteration to plant (no details or cost being given) with amazing results. The total number of units employed prior to re-arrangement was 718; this was reduced to 628—90 units saved. Of course there is the question of whether too many unnecessary units were employed previously and this example cannot be taken as a general rule.

Labour-saving can be carried to extremes, especially in two directions, namely reducing the number of units to a point where the lack of supervision and essential control of process is impaired, causing serious delays, possible loss of life and inefficiency of overall recovery of the product. The other is the installation of plant of such a nature that capital expenditure, maintenance cost, spares and employment of extra artisans to maintain the plant outweigh the saving of replacing labour units. This is an important point.

The shifts as at present constituted, i.e. 8 hours with a 20-minute break, necessitates employing extra units in all departments so as to enable the 20-minute break to be taken, otherwise this could not be adhered to as required by Government proclamation.

A great deal has been said and written in regard to the low labour complements in Australian sugar factories in comparison with the factories in this country—and there are two outstanding factors which undoubtedly assist in bringing this about:

1. Australians brought in their white labour policy as far back as 1906 when the natives from the adjacent Pacific Islands and the Japanese employed by the sugar industry there were repatriated. They have been devising ways and means during the last forty years of reducing the number of units in their sugar factories.

2. The type of labour in use differs materially from that available in this country, especially in intelligence, co-operation and the capability of being able to reason things out for themselves in the right direction. Further, the fact that they perform and carry out all the manual duties assigned to Natives and Indians in this country have made them resourceful, hard working and willing to carry out many operative duties which are performed by two or three labour units in our factories to-day. These facts alone are great saving innovations, certainly in numbers, if not in £ s. d.
From statistics published in the 1945 "Forty-Sixth Annual Report of the Bureau of Sugar Experiment Stations, Queensland," the average output of 32 factories is 21,000 tons sugar per season—lowest 2,632 tons and highest 40,692 tons; only two factories are in the latter grade. 25 factories produce under 25,000 tons sugar each per season.

From these figures it can be seen that the majority of factories are much smaller units than those in this country. Nevertheless, our labour strengths cannot bear comparison and the matter must be taken more seriously than has been the case in the past.

Members of the Factory Labour-Saving Appliances Committee are:

G. WILSON. A. H. RISHWORTH.
J. H. ROYSTON. G. SEYMOUR.
G. DYMOND. F. B. MACBETH,
(Chairman).

Mr. Moberly said he had often been struck by the large number of labour units used in the mill yards and about the outer buildings, and he thought our method of cane loading was wasteful in labour. The grab system of unloading always left some cane in the truck to be handled again, and more consideration should be given to efficient tipping devices.

Spilling of cane, especially where the carrier entered the knives, was another undesirable feature. Properly constructed shields could guide nearly all the cane into the knives, and a large amount of labour could be saved at this point. Quite a number of boys were also used to clean our mill beds from falling bagasse, and here the rake type of carrier will reduce this waste. In Australia, where all carriers were of the rake type, a number of mills were using the so-called "kangaroo," which swept the mill bed clean of falling bagasse. There all the milling units were driven individually and the Killer hinged plate was used, which governed the speed of the unit according to the quantity of bagasse passing through. They also used automatic stokers in their furnaces and the bagasse was supplied in accordance with the pressure needs.

We have made considerable strides here in the introduction of automatic scales, and the automatic pH control was at present being introduced. Continuous settlers would probably replace the old settling tanks altogether. There was big scope for automatic evaporation control in this country, and here we could learn from the experiences of other countries. Australia used far less labour on centrifugals than we do, and the use of high-speed self-discharging centrifugals would help a great deal to cut down labour in this department.

There were still a number of factories in this country which employed too many boys for sugar stacking. These labour units could be cut down very considerably by the installation of stacking devices, as had been demonstrated by so many other factories. Laboratories should be so sited that samples could be easily obtained by simply tapping the various pipes for the samples required, and that the residues from samples could be put in a chute and be returned to the factory. Laboratories should, however, be free from vibration, and if sited inside a factory its foundations should be deeper than that of the mill and it should form a structure on its own. High temperatures and excessive noise should also be avoided.

Much could be done to have the general layout of a factory so that labour could be saved, but unfortunately that was not always possible in old factories that have grown up gradually.

Mr. Feltham felt that it was easy to suggest ways and means of saving labour, but these might not always be economical. The type of unskilled labour in South Africa was very ignorant, and he suggested that more attention should be given to the training of these boys to do specific jobs.

Mr. Macbeth, in reply, stated that he agreed with Mr. Moberly that the tipping of trucks was more efficient than the grab system, and in fact it was used for small trucks, but the trouble was in dealing with the S.A.R. trucks. Here the Government was most unhelpful. They had tried to get such trucks for their limestone, but the Government insisted on having its own official to supervise the operation at a cost of £30 to £40, plus housing, to the company.

The design of milling beds was most important, and unfortunately some of the older mills were at a disadvantage here. He favoured the conical beds as now used at Empangeni.

He thought, from personal experience, that Australian conditions were rather different from ours. For example, their juice preparation was much simpler, and in general there was not nearly so much plant to look after as here.

Evaporation control might be improved, but the saving of labour would be small in most factories, and cost of maintenance of the electrical devices might conceivably outweigh this small benefit.

In many factories a number of labour units could be dispensed with in the factory yard by using a tractor or a winch for shifting trucks, etc.

Mr. Grant said that most factories have since 1939-40 been taking drastic steps to reduce labour as far as possible. It was, however, necessary to get the co-operation of the whole of the staff, and he thought the system of paying bonuses to employees who could suggest ways of saving labour in the factories was a very good one.
Mr. Macbeth agreed that it was essential to get the co-operation of the staff in tackling these problems, but it was difficult to get any assistance from a certain type of labourer. Bonus systems might work well, but there were certain disadvantages attached to them. In any case, before adopting a labour-saving device, care should be taken to see that efficiency was not impaired.

Mr. Lewis felt that labour-saving devices might be overdone. It was always necessary to determine carefully the capital expenditure and the cost of maintenance of any new device, and to compare that with the possible gain from saving a number of labour units. He was interested in the discussion on the construction of mill beds, and particularly the conical beds. He was lucky in not having much spilling of bagasse, but it certainly could constitute a problem in some mills.