EUROPEAN COAL AND STEEL COMMUNITY

Community Ergonomic Research

DOC. N° 395/72 e RCE
Original : Dutch

Translations : French, German
Distribution : Enterprises

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EMPLOYMENT OF EX-MINERS IN LOADING FERTILIZER

Source : Ergonomic team of the Netherlands coal mining industry
Project n° 3

Authors : Dr. G.B.M.L. KOENE, L. RUWETTE

Reference period : 1.12.1968 - 30.11.1970

65.015 + 445.01

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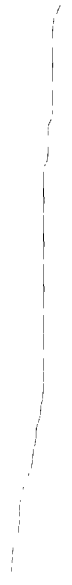
In the Fertilizer Loading Department of the nitrogen works of N.V. Nederlandse Staatsmijnen/D.S.M. an attempt was made to apply ergonomic principles to a series of practical situations. The work was launched with great enthusiasm and is still far from completed. Under the existing working conditions it is quite impossible to meet all ergonomic requirements.

The ergonomic study of fertilizer loading was highly instructive for all concerned. Above all it showed how complex problems difficult to size up as a whole ought to be tackled. This report is intended mainly to demonstrate how, on the basis of systematic observations, insight into these problems can after all be gained. The report gives only a slight idea of the energy and determination that went into this study. The results stand in no sort of relation to the expenditure of effort. The conviction that vital knowledge could be gained from all the hard work put in encouraged us to describe what has so far been achieved as clearly as possible.



CONTENTS

CHAPTER I

THE PROBLEM

The large number of products from the chemical works of N.V. Nederlandse Staatsmijnen/D.S.M. are prepared for dispatch in a central department. The products - mainly fertilizers - are carried on a conveyor belt from the stores to the Loading Department, where they are loaded onto lorries or railway wagons. For this purpose, part of the products have to be bagged.

Work in the Loading Department ranges according to an overall grading system from light to heavy. Some jobs, especially the stacking of bags containing fertilizer on railway wagons, rank as extremely heavy. Under a medical regulation, this work must not as a rule be carried out for two shifts in succession. Hence the need for a rota for the various jobs. Consequently everyone - save in the case of one or two special duties - is expected to perform any of the jobs.

Manpower turnover in the Loading Department has always been high, so that it was always made up of fairly young men who stayed only a short time.

Following pit closures, the Loading Department appeared at first sight to offer suitable scope for employing ex-miners.

At the time this study was being carried out, a hundred or so ex-miners were already working in the Loading Department. This meant that personnel structure became more stable and that the average age of

workers would rise. A rise in average age will, however, lessen interchangeability of personnel. It was feared that this might clash with the principle that everyone ought to be able to perform any job in order that no one would have to carry out stacking duties for two successive shifts.

The question to be gone into was therefore how far working conditions could be altered so that a stabler personnel structure, with the attendant rise in average age, would not endanger performance. Solving this problem was also expected to provide extensive job opportunities for ex-miners not eligible for retraining.

CHAPTER II

PRELIMINARY SURVEY OF THE LOADING DEPARTMENT

Introduction

On a first visit the way the Loading Department is run appears difficult to grasp as a whole. This is partly due to the equipment used which has become more and more complicated. New parts have been added to secure new loading facilities; as a result these have become highly varied. But for the newcomer who has to find his way about in unfamiliar surroundings, the situation in the Loading Department is not easily understood. The entire pattern of activity is made all the more complicated for him by the large number of customs and procedures that have grown up over the years. These are based on the eligibility, assumed or proven, of persons for particular jobs. In other words, a personnel policy, sometimes more and sometimes less clearly defined, has been developed. A good deal of this appears to rest on assumptions of which it may well be asked whether they correspond to the facts.

A lengthy observation period is needed to gain a measure of insight into the technico-organizational and personnel aspects. To acquire a grasp of the way things are done and get a more or less systematic overall picture requires considerable time.

To learn more about the way the Loading Department is run, we began by drawing up an organization chart.

Organization chart

The Loading Department is a completely independent unit within the complex of the chemical works. In it the various products of these works - mainly fertilizer - are packed, loaded and dispatched. The personnel pattern differs noticeably from that of the other works. First, no more than a minimum of previous training is required, instruction in the handling of equipment being given on the spot. Secondly, the work is physically exacting.

To get an overall picture, the organization chart (Fig. 1, Annex I) should be studied.

The head of department is served by a staff and by a further group responsible for customer contacts. He is also assisted by the Loading Manager.

The Maintenance Section and the Planning Office come under the Loading Manager, who is also responsible for Stores. He is assisted during daily loading operations by the Work Supervisor.

At the time this study was being carried out the Maintenance Section consisted of 26 persons. This section is independent of actual fertilizer loading operations. It is responsible for the constant upkeep of technical equipment but carries out no major repairs.

The Planning Office draws up weekly and daily programmes on the basis of orders from a central sales office. These programmes specify the persons assigned to each workplace. It is through the Planning Office that contact is first made with job allocation in the Loading Department. It would be as well, therefore, to describe the Planning Office and its activities separately and in some detail.

The main task of the Work Supervisor is to keep an eye on the work of the different shifts. Work is carried on during the morning, afternoon and night in three alternating shifts. No work is done over the weekend. Again, it would be as well to describe the composition of the shifts and the work they perform separately and in some detail.

The Work Supervisor is also responsible for training and management. The training group is made up of two persons who introduce newly engaged workers to the department and instruct them in safety measures. They are also responsible for drawing up, revising and renewing operating instructions. They also prepare plans of technical equipment and loading routes. Shift leaders, foremen and fellow-workers give instruction in the handling of the various appliances.

Administrative duties are very simple and are performed by one person.

Planning Office

The Planning Office has a staff of three who draw up weekly and daily programmes on the basis of orders from the central sales office. The weekly programme specifies the types of product to be loaded, their quantities, destination and type of packing and transport.

The daily programmes contain essentially the same information but provide more details regarding jobs assigned to the various shifts. Above all, however - and this is important - the daily programme gives the loading routes to be followed. It therefore decides how workplaces are to

be filled and determines, with the help of the Work Supervisor, at what point each available worker in the shift is to perform his job.

The term "loading route" calls for further explanation.

Attention is first drawn to the plan of loading routes shown in Fig. 2, Annex II.

Fertilizer is carried on conveyor belts out of the factory to the Loading Department, where it is stored in a shed in which it must remain for at least eight days.

Each shed contains a mechanical scoop operated by a machinist and an assistant. With this machine the product is again transferred to a conveyor belt which carries it via an intermediate building back to the factory, where it undergoes further aftertreatment.

The product is returned to the Loading Department on conveyor belts via the intermediate building and stored in bunkers. The bunker hand ensures uniform flow from bunkers to filling machines.

The fillers allow the filled bags, which weigh 50 or 100 kg, to fall onto a moving belt. Where bags are used with large filling apertures, they must subsequently be stitched up by sewers or sealed by sealers. Neither operation is necessary with valved bags.

The check-weigher must weigh every fifteenth bag and, if deviations in weight are excessive, adjust the weighing devices above the filling machines.

The bags are conveyed on belts from the filling machines to a railway wagon or lorry onto which they are loaded by stackers.

The laden wagon is drawn onto a weighbridge by means of a winch. The weigher checks whether the wagon contains the requisite number of bags. After this the wagon is sealed. Subsequent transport is then taken over by the forwarding department.

To give a more concrete idea of the process, two loading routes will now be described.

The product arrives via conveyor belts 43 and 44 at main bunkers H1 and H2. It can thence be carried via belt 245 to the two bunker filling machines BV 1 and BV 3. Each bunker is provided with two Libra scales. Arranged below these are Bates filling machines BV 1 and BV 3. Filled bags are carried off on belts 261 and 248, between which check-scales are arranged. They are collected on belt 266, pass a halt and then arrive on belt 267, via a wagon loader, at the wagon on track 6. Once the wagon is loaded, it is drawn by winch to weighbridge 69 and checked for weight.

A further example : The product again arrives via conveyor belts 43 and 44 at main bunkers H1 and H2. It is then carried on belt 371 to bunker filling machines BV 9 and BV 10. Each bunker is again provided with two scales. Use is made of different types of filling machines, depending on the nature of the packing. The filled bags then pass onto slat conveyor belts 310 and 311. While on these belts the bags, depending on the type, again pass the sealing and/or sewing points. Check-scales are installed between the slat conveyor belts. From belts 310 and 311

the bags pass onto belt 312, pass a halt, and then move from belt 374 to belt 373. They then pass onto belt 37 to be loaded onto lorries.

Fig. 2 of Annex II and the examples of loading routes should convey some idea of the complexity and variety of loading routes. In practice more than ten variations in packing and loading can be resorted to in this way.

Shifts

Each shift has a leader. Before the shift begins, he decides each day, in the light of the programme, the workplaces to which members of his shift are to be assigned.

Shift A is made up of six foremen and 80 operators, of whom one carries out simple administrative duties and three work as fitters.

Shift B is made up of eight foremen and 75 operators, of whom one carries out simple administrative duties and two work as fitters.

Shift C is made up of six foremen and 73 operators, of whom one carries out simple administrative duties and one acts as fitter.

In addition to these alternating shifts, a special shift always works during the day. This consists of 15 operators working under one foreman. These men are responsible for loading a special part of the product and also perform a number of additional jobs.

The tasks assigned to a shift depend on the loading routes; these in turn depend on the type of packing, the product, and the means of transport (rail or road).

There are a great many loading routes. This variety makes it difficult to obtain an overall picture. In the final analysis it is all a matter of assigning operators to a limited number of workplaces.

Fig. 2 of Annex II shows the number of operators assigned to particular points.

It was stated in Chapter I that all operators should be able to take their turn at any workplace. A closer study of the variety of jobs to be done soon raises doubts as to whether this proposition corresponds to the real situation. One might suppose that in allocating jobs shift leaders take individual aptitudes into account.

To test this assumption, we asked shift leaders which operators they thought best fitted to various jobs. It was then ascertained how many shifts at the different workplaces were worked by each individual, and how many of them were worked by operators whom shift leaders preferred to see occupying the workplaces in question. Table 1, Annex III, shows the situation. Quite obviously most of the shifts were worked by persons whom shift leaders preferred for a particular job. This applies at least to stacking. Here, however, strict medical regulations lay down that no one must be put on stacking duties for two of more successive shifts. It was noticeable that these operators alternated stacking duties with

preparing wagons, cleaning, and collecting packing material. In practice the composition of each shift appears to fall into two distinct groups : one to operate the different machines (each operator working mainly with the same type) and the other to perform heavy physical labour.

Summing up, it can be said that members of the Loading Department appear to be tied to the workplace to a far greater extent than is assumed.

This has important consequences. The requirements to be met in allocating workplaces can be made less general in application. Not everyone can fulfil the same requirements. And in practice a solution appears to have been found. The assumption that differentiation is only slight does not appear to be borne out in practice, which indicates that a clear-cut differentiation by activities is not only possible but in fact exists. If these workplaces were better laid out, such differentiation might perhaps be brought out even more clearly. A study of the different workplaces is therefore necessary.

CHAPTER III

CLOSER STUDY OF WORKPLACES

As we saw in the previous chapter, activities in the Loading Department fall into two groups. A distinction can be made between the stacking of bags on wagons or lorries and the operation of equipment.

Stacking

Stacking is preceded by loading by means of wagon loaders fitted with a boom. This means that stackers must seize bags in quick succession from the boom and stack them. A great deal of time and trouble went into the search for an improved type of loading boom. Among other possibilities, that of transporting bags on an air cushion was explored, but without success. The main difficulty is in laying down the bags so that they face in the right direction and in stacking them carefully to prevent them from shifting during transport.

Closer study shows that many operators have got the hang of seizing and stacking the bags and carry out this arduous work with relative ease. Others display noticeably less skill and soon tire. Probably a motion study would bring out the distinctive features of the working methods of the most skilful operators. When more is known about correct working methods it will perhaps be possible to teach them systematically to the others.

Operation of equipment

Even superficial examination shows that in a large number of cases workplace layout is not all it could be. To convey soms idea of the position, a number of workplaces will be described.

1) Description of workplaces

This consist mainly in defining the duties involved. Activities were then analysed on the basis of the workplace card. A sketch was made of the equipment and of the work situation, which was also described. Four of these workplace descriptions are given in Annex IV to VII.

This approach was soon found to be impracticable. Admittedly the descriptions were clear; they showed that workplace layouts were not the best possible and even put forward suggestions for their improvement. On the other hand, they are not so instructive for someone who does not look at things from a strictly ergonomical point of view.

The main drawback, however, was that these descriptions were too wide in scope and that as a result only slow progress could be made. It seems impossible in practice to make an inventory along these lines within a reasonable space of time. We had to think up another approach.

2) Photographs of workplaces

The description of workplaces proved to be too laborious. It took weeks to complete some of the descriptions. We therefore sought an easier and handier method. The suggestion was made that the different workplaces could be photographed. This would take only a matter of hours. The following conclusions can be drawn from the photographs taken.

The stills clearly bring out the strained working postures, which were often less apparent under direct observation. Annex VIII contains a

number of such photographs, which clearly show the faulty or strained postures assumed by operators. The photographs highlight postural situations which often passed unnoticed during on-the-spot observation. The prints, which were soon developed, made it possible to study the various work situations and compare them with each other in a very short time. In any case the photographs were highly convincing because of the graphic way in which they portrayed the work situation.

It was noticeable from most of the working postures that attempts had been made in the past to arrange the level of work in such a way that the job could be carried out seated. This object was only partly attained because when an operator is seated before conveyor belts his movements are constantly hindered by lack of knee space. Inadequate reach must be compensated by bending forward or twisting the body, or even by excessive spreading out of the knees. In our opinion a solution to the problem must be sought in substituting a standing for a sitting position.

CHAPTER IV

SUGGESTIONS FOR IMPROVING WORK SITUATIONS

Stacking

No acceptable solution could be suggested for stacking operations. Every attempt to design a new wagon loader proved a failure. The problem would probably have been less difficult had it been possible to remove the sides of the wagons to be loaded. This, however, is so drastic a step as to rule out any short-term solution. The three-piece wagon loader at present in use remains, in the circumstances, the best arrangement.

If training methods could be improved by means of motion studies, there might perhaps be a way of lightening this strenuous work.

Operation of equipment

It became apparent that the strained and unnatural postures taken up by operators were due to the fact that they performed their work seated. Fig. 3 of Annex IX clearly shows that the actions the sealer has to carry out by hand are beyond his optimum reach when he is sitting in a normal position. The only answer is for him to do his job standing.

If, however, the operator is to stand, the work must be brought to the right level. This can be done only by raising the conveyor belt or lowering the surface on which he stands.

The first solution is virtually ruled out by the enormous costs involved. Raising a conveyor belt affects all interposed equipment. It was therefore suggested that the surface on which the operator stands should be at a greater depth, as shown in Fig. 4, Annex X. The operator then takes up a standing position in a kind of pit.

This arrangement was adopted at different workplaces on one loading route. A return was soon made, however, to the old situation. One reason for this was that the ideal working level varies from person to person. This difficulty could have been overcome by giving the pit the maximum depth and then raising the level, to suit the individual and the situation, by laying down wooden boards. The ideal working level depends not only on the operator's height but also on the type of packing used. It is not the same for 50 kg as for 100 kg bags.

Psychological factors also played a part in the rejection of the new work situation. The fact that a new situation is not in any case readily accepted also certainly had something to do with it. It was not, however, in our opinion the main ground for rejection.

More important was the fact that operators do not feel very happy about standing in a pit and doing their job from such a low-lying position.

After all, operators prefer to sit badly than to stand in comfort. It should be borne in mind, however, that the effects of sitting uncomfortably gradually make themselves felt. This is a problem that deserves closer attention.

Concluding remarks

Our impression is that we are able to learn a great deal from the study. We found out how one can after all gain an insight into problems in a situation that is extremely difficult to size up as a whole. Compiling descriptions of work situations taught us much whose practical utility we were able to verify.

It must be conceded that ergonomic remedies at a given moment cannot be confined to simple, inexpensive measures. Remedying false work situations can be an extremely costly business. This is yet a further argument for drawing upon ergonomic know-how from the outset in designing a new plant.

A N N E X E S

Annex I

Fig. 1 - ORGANIZATION CHART - Loading

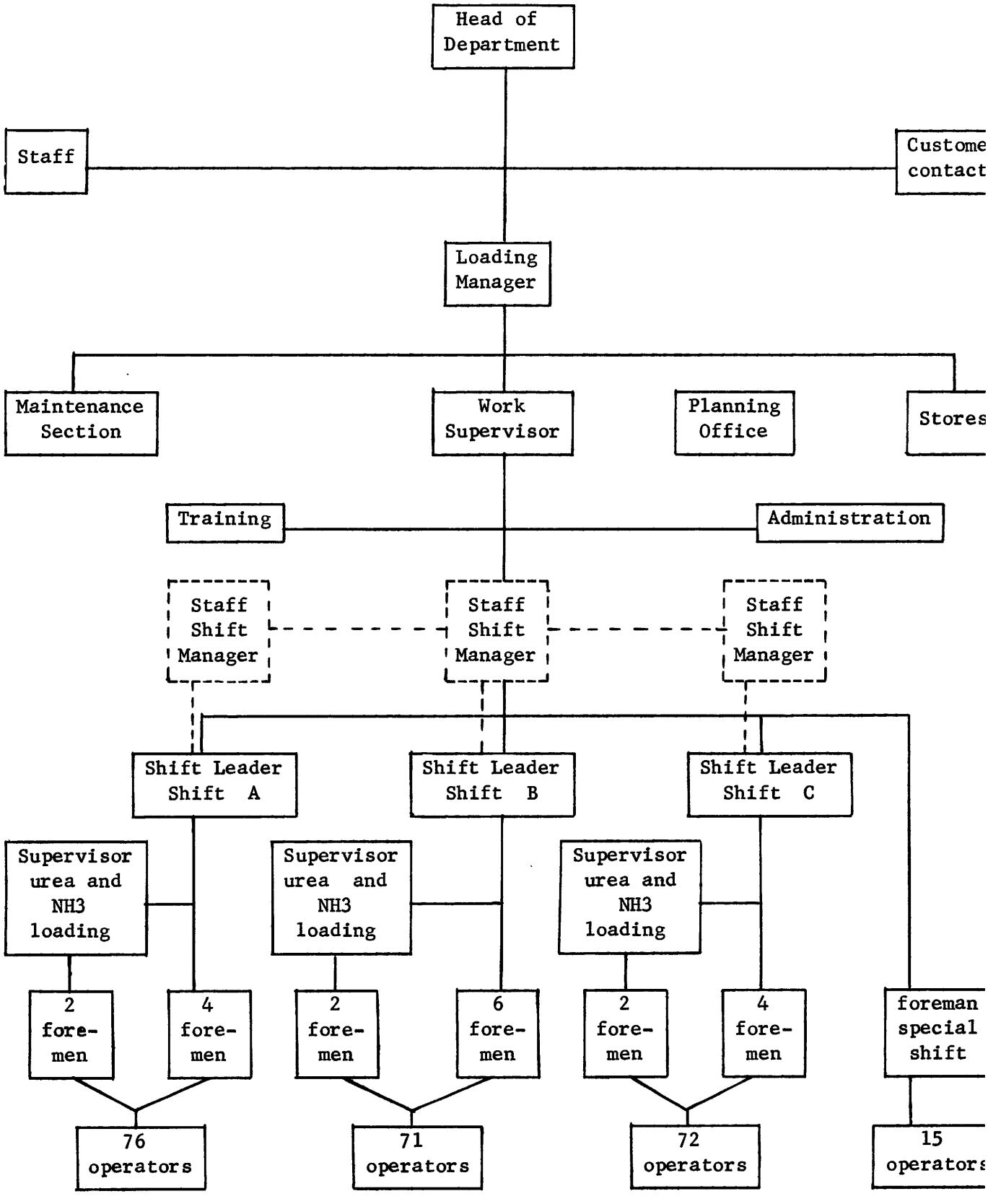
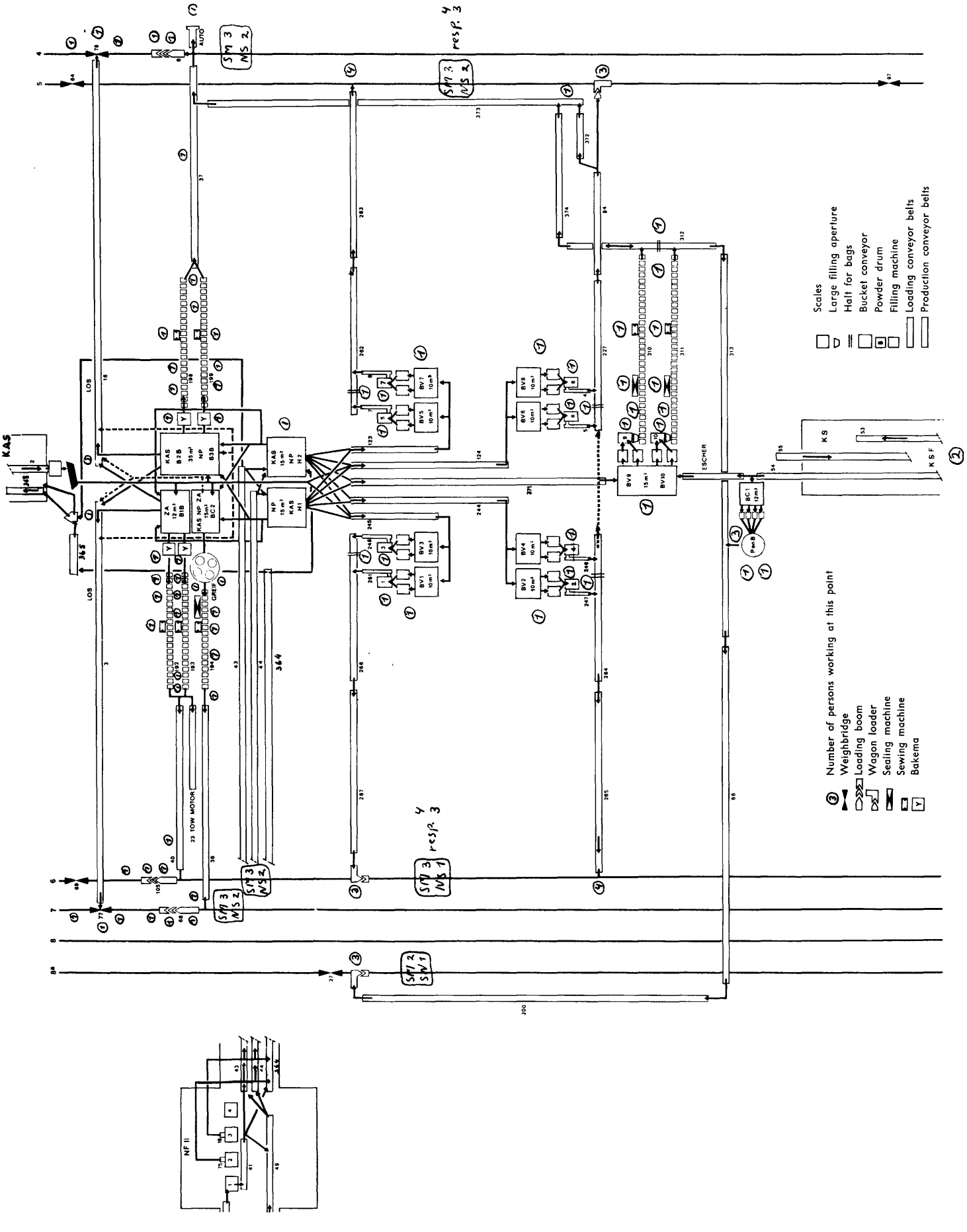


Fig. 2 - FERTILIZER LOADING ROUTES



ANNEX III

Table 1 - Filling of workplaces with the same persons per shift during a period of 12 working days. Under the column "Number of persons" are nominally entered personnel whom shift leaders prefer to have at that workplace.

Workplace (job)	SHIFT A			SHIFT B			SHIFT C		
	Number of persons	Number of possible shifts	Number of shifts at the workplace in question	Number of persons	Number of possible shifts	Number of shifts at the workplace in question	Number of persons	Number of possible shifts	Number of shifts at the workplace in question
Machinist for mechanical scoop	9	105	89	10	110	100	13	129	100
Bunker hand	4	45	40	6	67	45	3	29	28
Filler	7	83	52	9	107	74	8	80	56
Sewer	4	47	22	2	19	12	1	11	6
Check-weigher	6	66	50	4	46	39	5	47	27
Manual stacker	16	187	68[X]	14	155	41[X]	17	147	51[X]
Stacker for wagon loader and/or pusher	7	82	58	7	77	59	6	53	32
Pusher operator	1	9	7				1	12	10
Cable winch operator	1	12	10	2	24	16	2	21	14
Weigher	6	71	56	7	83	67	6	61	44
Waste shed				1	12	12	1	9	6
Crane driver	1	12	11	2	24	13			
Storeman	1	7	7	1	12	12	1	11	11
Cleaner	2	24	13	1	12	12	1	9	8

X During remaining shifts : prepare wagons, clean and procure bags

Annex IV

Job description : Filler (with large filling aperture)

Location of workplace

The workplace is situated at the start of slat conveyor belts 310 and 311. The filling aperture hangs above the belt and the filler is seated on the platform (see Annexes IV-1 and IV-2). The filler reaches his workplace via a small flight of steps. Height of platform : 84 cm.

Process

When loading is carried out with the large filling aperture, this is situated below the bunker of the Libra or Molenschot scales (see Annex IV-3). The filler dumps the product weighed by the Libra or Molenschot scales into the filling aperture by pressing an operating switch. With the same switch a plastic bag is clamped in position below the filling aperture. Before the filler presses the switch the product rests on one of the scale pans. When the filler presses the switch :

- the bag is clamped below the filling aperture,
- the pan tips over.

The bag remains clamped in position for a total of 4 seconds, after which it is automatically detached and drops onto the slat conveyor belt which carries it to the sealing machine. To each filling aperture are assigned two scales which are used in turn so as to leave sufficient time for the weighing operation.

Annex IV

Preparations

When the filler arrives at his workplace, this has already been prepared by the fitter. Preparations consist in :

- Arranging the large filling aperture below the scales.

  The filling apertures hang from a rail. By means of a winch, either the filling machine or the filling aperture can be moved under the scales. If the filling aperture is to be used, then - as can be seen from the drawing in Annex IV-3, the entire assembly must be shifted to the left.

- Lowering the platform alongside the slat conveyor belts.

- Detaching bag-holder and filler connections from the Bates filling machine.

- Fitting guides for the bags :

  on conveyor belt : between sealer and filler
  on platform between sealer and sewer (this part normally lies loose on the ground).

- Switching on the large filling aperture electrically.

Filler

The filler sits on a chair before the filling aperture. Next to this on the platform is a table on which lies the empty plastic bags (see Annex IV-2). With his right hand the filler takes a bag from the table. With both hands he opens out the bag and holds it with outstretched arms under the clamping device. With the upper edge of the hands he then presses

down the operating switches. These are fitted 8 cm above the clamping device, one to the right and one to the left of the filling aperture.

Note : It was occasionally observed that the filler fixed one of the switches so as not to have to push them down with both hands.

Actions performed by the filler :

- Takes bag from table.
- Opens bag at upper edge.
- Brings bag under filling aperture.
- Presses switches.

The cycle time is from 6 to 8 seconds.

Description of workplace

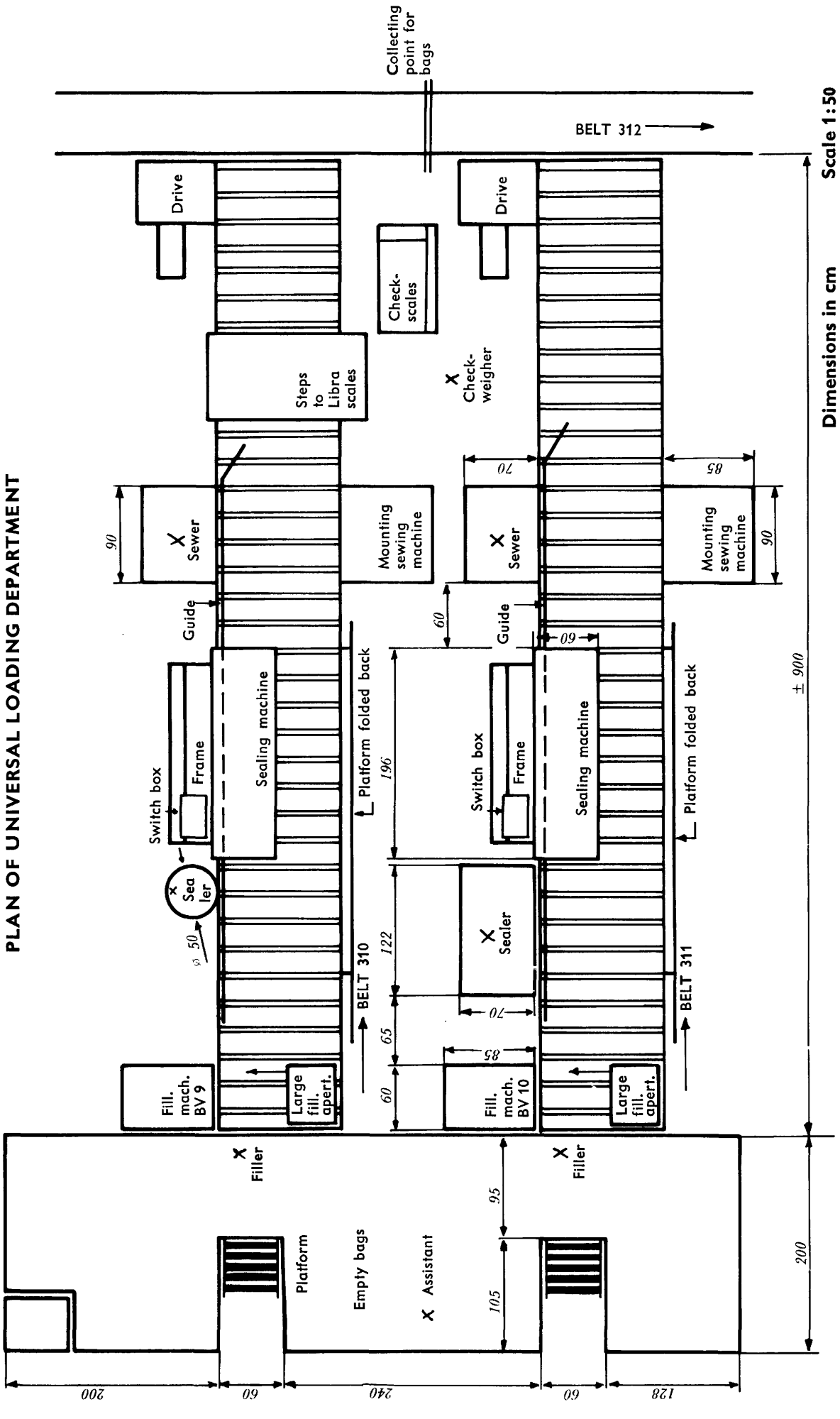
So that he can perform his duties seated, a chair is provided for the filler. To bring himself up to the right level, he has placed on the chair a plastic bag stuffed with waste. The bag is secured with cord at the back of the chair. The filler can make no use of the chair back (see Annex IV-4).

The platform in front of and alongside the slat conveyor belts consists of steel plates. The table for empty bags is 48 cm high and 90 cm long. As the width of platform 85 when let down is 85 cm, one of the table legs has nothing to rest on. A piece of (loose) hardboard was therefore laid on the platform so as to give that leg some support. It should be possible to improve this arrangement by some simple measure, e.g. adding an extension piece to the platform.

Annex IV

Next to the platform is the hand winch for positioning the filler connection on the Bates filling machine. Fitted vertically alongside the winch is a steel plate to shield operators from product spurting accidentally out of the Bates filling machine. In such a case the product falls along the plate onto the floor grating. Nevertheless one cannot help wondering whether a loose steel plate is acceptable from the safety point of view. The plate hampers the fitter's movements when he operates the winch.

The material used for the operating switches is a type of foam rubber.


PLAN OF UNIVERSAL LOADING DEPARTMENT
Scale 1:50
Dimensions in cm
Collecting point for bags
BELT 312
Drive
Drive
Check-scales
Steps to Libra scales
Check-weigher
Sewer
Sewer
Mounting sewing machine
Mounting sewing machine
Guide
Guide
Switch box
Frame
Sealing machine
Platform folded back
Switch box
Frame
Sealing machine
Platform folded back
Sea ler
Sealer
BELT 310
BELT 311
Fill. mach. BV 9
Large fill. apert.
Fill. mach. BV 10
Large fill. apert.
Filler
Filler
Platform
Empty bags
Assistant
± 900
200
95
105
90
70
85
60
122
65
196
240
128

PLAN VIEW OF FILLER'S WORKPLACE (WITH LARGE FILLING APERTURE)

Dimensions in cm Scale 1:25

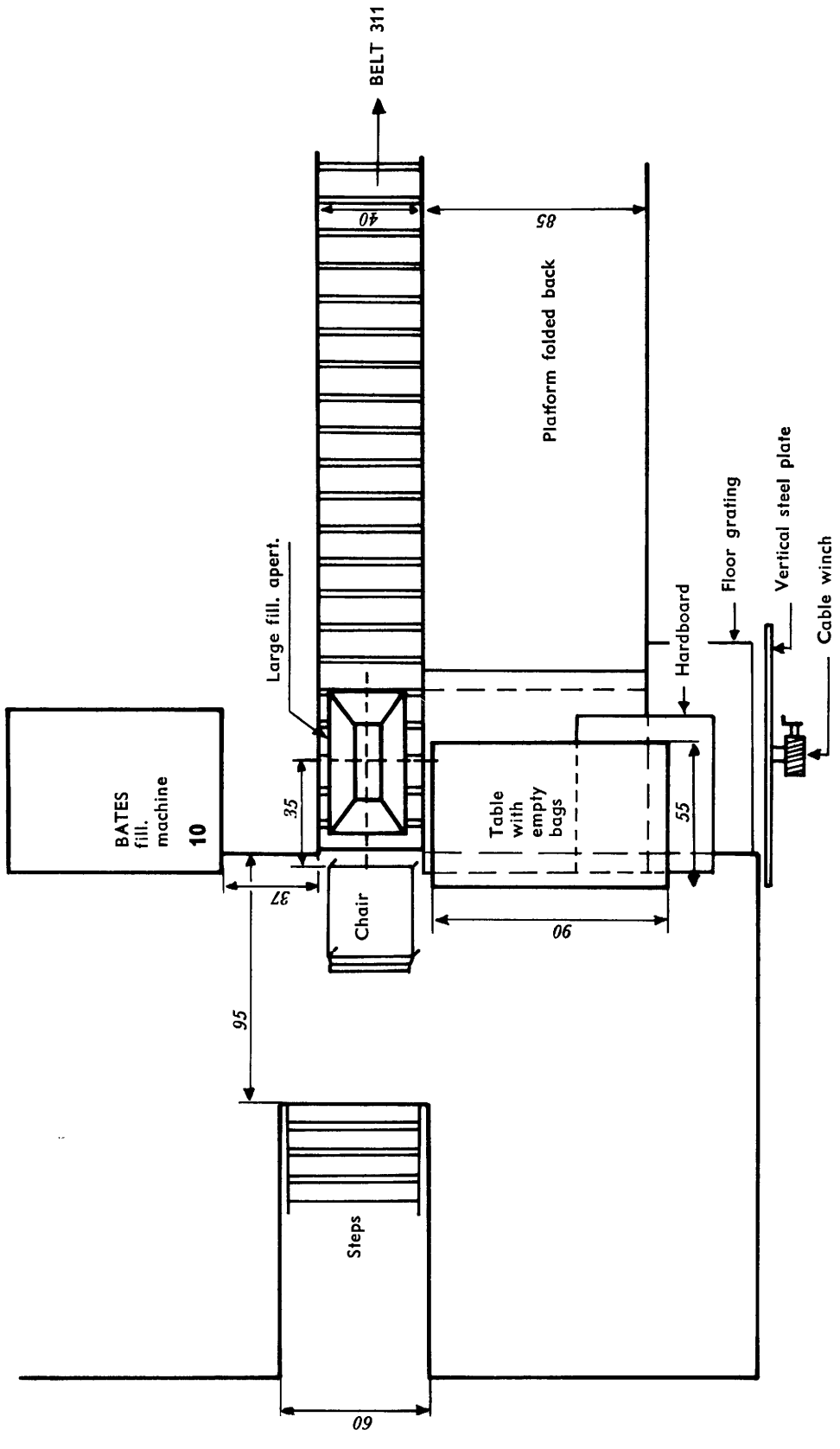
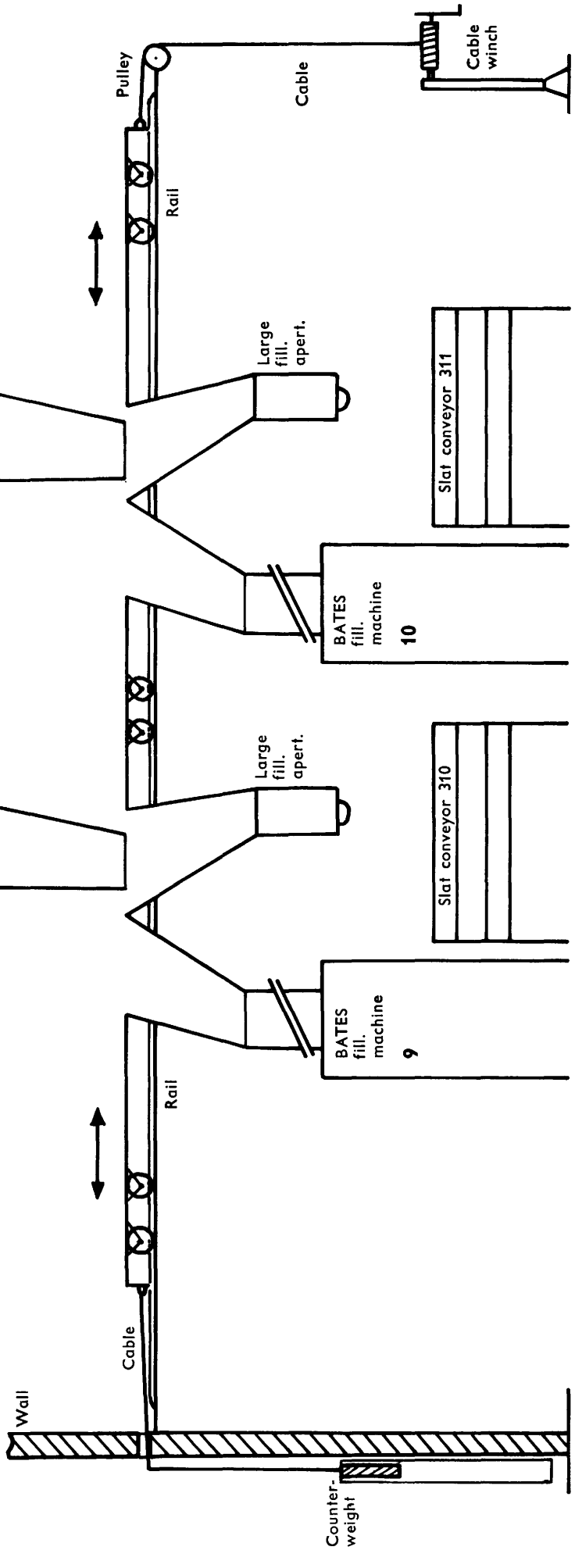
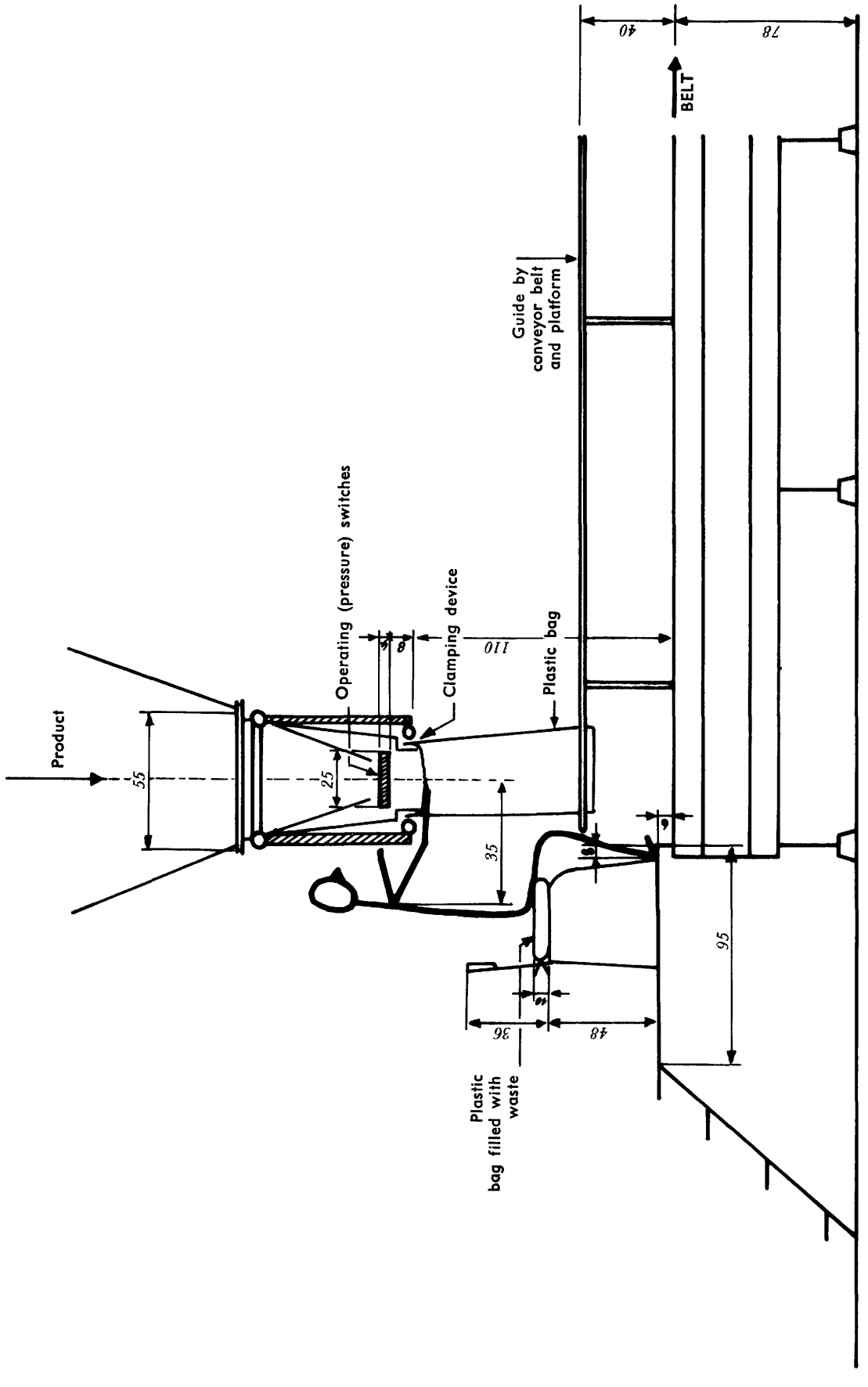


DIAGRAM OF LOADING PROCESS WITH A BATES FILLING MACHINE OR A LARGE FILLING APERTURE



SIDE VIEW OF FILLER'S WORKPLACE (WITH LARGE FILLING APERTURE)



Dimensions in cm Scale 1:25

Annex IV - 5

Works	Department	Workplace/Duties	Date
S.B.B.	Loading	Filler (with large filling aperture)	April 1968

	Criteria for the assessment			Remarks
V I	Close by	Empties bags on table	1	25 x 10 x 4
		Circular opening of clamping device	2	
		Operation of pressure switches	3	
		Clamps and releases bags	(4)	
			5	
S I	Far off	No requirements	1	
			2	
			3	
			4	
			(5)	
O N	Colours	No requirements	1	
			2	
			3	
			4	
			(5)	
Hearing		Noise from pneumatic clamp according to which he regulates his activities	1	
			2	
			3	
			(4)	
			5	

Annex IV-5-a

Muscular strength	Upper limbs	With right hand takes bag from table With left and right hands opens bag Inserts bag in clamping device Presses operating switches	1 2 (3) 4 5	Distance : 20 cm ± Ø 40 cm Distance : 35 cm Shoulder level (112 cm above platform)
Movement	Lower limbs	Works in sitting position No foot support, chair almost at edge of platform. Feet under chair. Flight of 4 stept to platform	1 2 3 4 (5)	
Posture	Back	Works sitting position Makes no use of chair back	1 2 3 4 (5)	

Annex IV-5-b

Use of hands	Grasps bag with thumb and fingers Presses operating (pressure) switches with upper edge of hand	(1) 2 3 4 5	
Staying power	Every 6 to 8 seconds takes a bag from table and slips on while in sitting position Presses operating switch(es)	1 2 3 (4) 5	
General	Regularity of operation of slipping on bags	1 2 3 (4) 5	

Lighting difficulties	No daylight. Neon lighting	1 2 3 4 (5)	
Noise	No hampering noise from filling machine	1 2 (3) 4 5	
Vibration	None	1 2 3 4 (5)	
Climatic conditions	Inside work	1 2 3 4 (5)	
Dust	Arises when detaching bag from clamping device Still to be measured	1 2 3 4 5	
Respiratory irritation	Still to be measured	1 2 3 4 5	
Skin irritation	Not known	1 2 3 4 5	
Toxic substances	Still to be measured	1 2 3 4 5	
Type of shift	Alternating shifts : morning, afternoon, night	(1) 2 3 4 5	

Annex V

Job description : Filler at Bates filling machine

Location of workplace

The workplace is situated, like the large filling aperture, at the start of conveyor belts 310 and 311. The filling machine stands next to the slat conveyor belt with its side against the platform on which the filler stands (see Annex V-1).

Process

Valved plastic bags are filled on the Bates filling machine. As valved bags are self-sealing, they need no further attention. Conveyor belts 310 and 311 carry the bags to collecting belt 312 (Annex IV-1). From there they are borne along to the wagon or lorry. On the "universal loading" route the fillers, the check-weigher and, if necessary, the assistants on the platform are now at work.

Stackers work in the wagon or on the lorry.

The filler

The filler must regularly fit the plastic bags onto the filling machine connections. The product does not pass through the same opening as when the large filling aperture is used, but issues in turn from the lefthand and richthand filler connections. The scales (2) above the filling machine weigh the product. Next to the filling machine stands the table with the empty valved plastic bags. With the left hand the

filler takes a bag from the table and passes it in front of him to the right hand. He opens the valve of the bag with the left hand and then with the right fits the bag onto the filler connection. With the left hand he pushes the button of the appropriate filler connection on the switch box. As a result the bag is clamped to the connection; the pouring device on the bag-holder is set into operation; the chronometer, which determines how long the bag is to remain clamped, is switched on; and the weighed product is tipped out of the scale pan. The product runs into the filler connection and into the bag through adjustable feed valves. The chronometer is set at $\pm$ 10 seconds. After 10 seconds the clamp is released, the pouring device on the bag-holder is halted, and the bag-holder is tilted over so that the filled bag drops onto the slat conveyor belt (310 or 311). The filler, however, does not have 10 seconds available for each filling operation because he must attend to two filler connections. He therefore has to work continuously. When, for example, a bag has been fitted onto the lefthand connection, he can at once grasp the bag for the righthand connection.

A red signal lights up on the switch box when the weighing of one filling on the scales is completed. The filler must not press the button before the lamp lights up. The scales pause a few seconds before coming into operation because the bag remains clamped for 10 seconds and the scales can weigh 50 kg in 8 seconds.

As the filler presses the button with the left hand, he continues to grasp the bag with the right for a short time.

Annex V

Preparations

The workplace is prepared by the fitter. Preparations consist in :

- Attaching two filler connections (per filling machine)
- Attaching two bag-holders (per filling machine)
- Folding back the platform next to the slat conveyor belt
- Dismanting guide beam by filling machine
- Connecting filling machine to Libra scales
- Switching on current.

At the beginning of the shift the filler checks :

- whether the machine is clean inside
- whether the filler connections are closed and bolted
- whether the bag-holder is at the right height
- whether the pivoted trap is open.

At the beginning of the shift two bags per set of scales are checked by the check-weigher, who adjusts the scales as necessary. The filler can then immediately start up loading. At the beginning of the shift the filler sets the slat conveyor and the filling machine motor into operation by pressing the button on the switch box (see Annex V-4).

Actions performed by the filler

- Takes bag from table with left hand
- Passes bag to the right hand
- Opens bag valve with left hand
- Slides bag onto filler connection with right hand
- Presses the appropriate pushbutton with left hand
- Continues to grasp bag for a short time with right hand.

The cycle time is $\pm$ 6 seconds.

Annex V

Note

While the laden wagon is being driven off, the filler cleans the filling machine : cleans filler connections, checks conveyor belt for straight running, sweeps out inside of machine, etc. If necessary, he places a fresh stack of valved bags on the table. There are two kinds of valved bags :

a) bags with the valve high up on the side

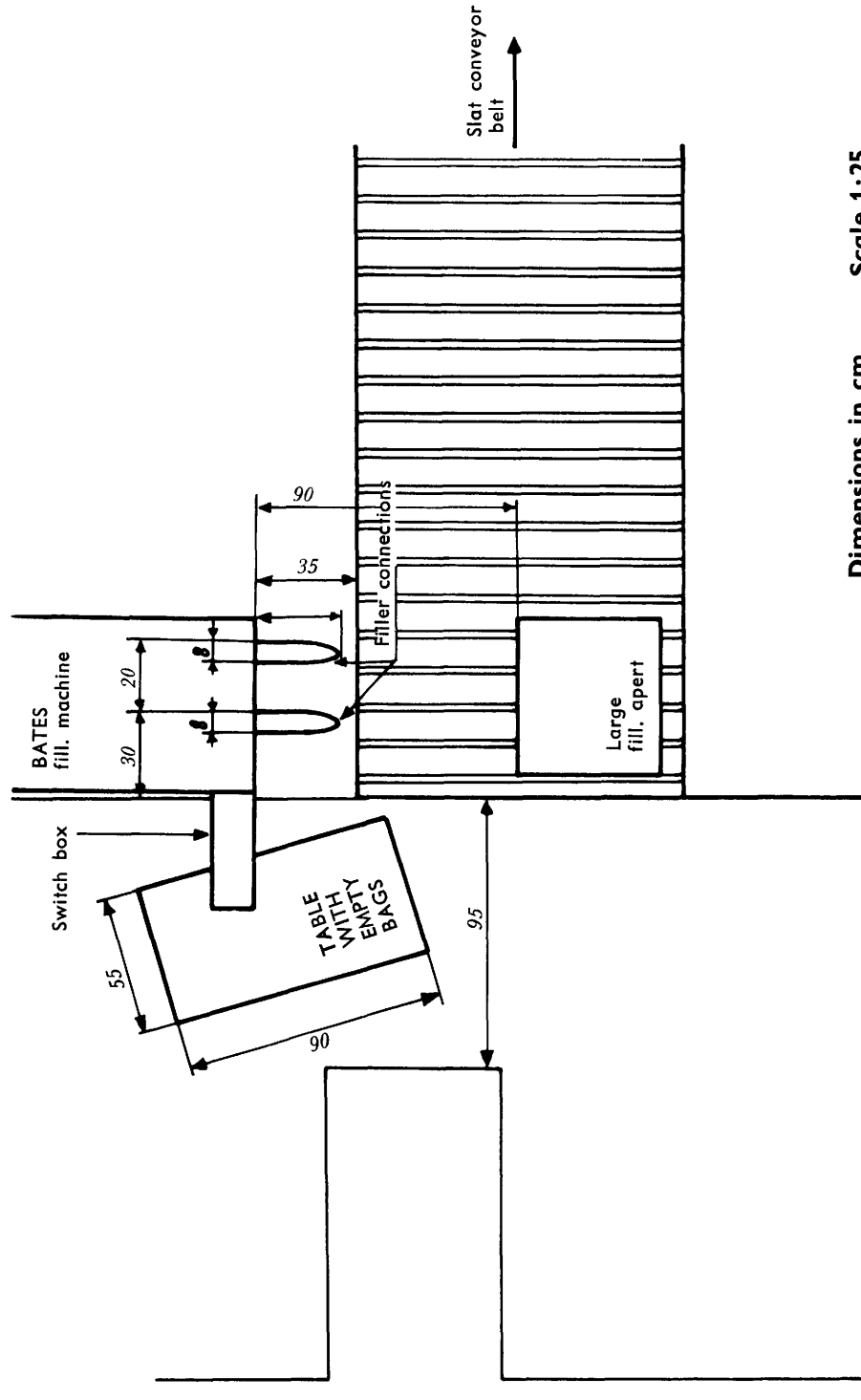
b) bags with the valve central on the upper edge.

Notes

The work can be performed either standing or sitting. As operators were not seated when the photographs were taken, the sketches show them standing. If the filler wishes to sit down, he can make use of a high chair. For the two fillers employed on "universal loading" only one chair is available.

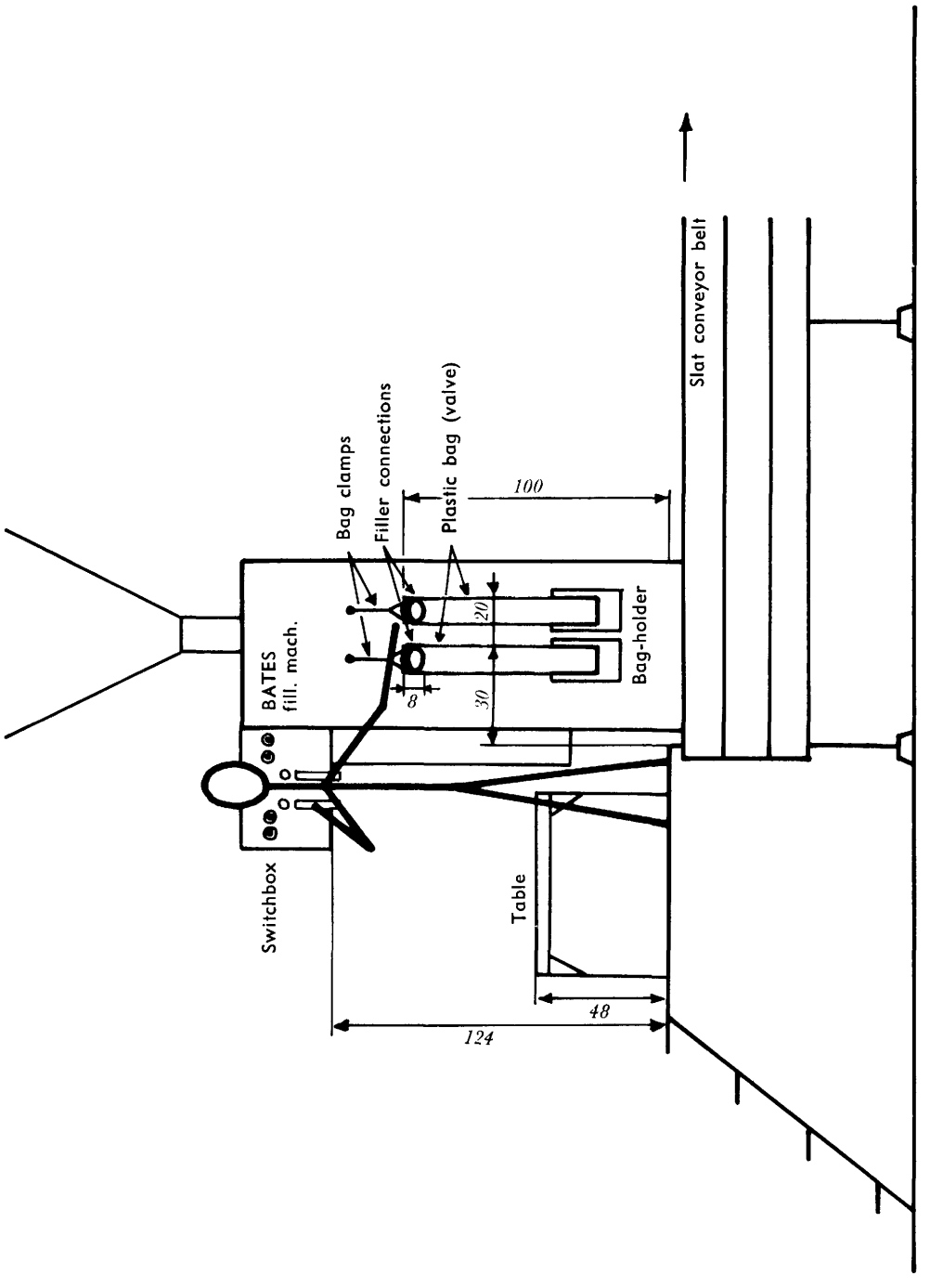
For description of workplace, see Annex IV.

FILLER'S WORKPLACE SEEN FROM ABOVE (WITH BATES FILLING MACHINE)



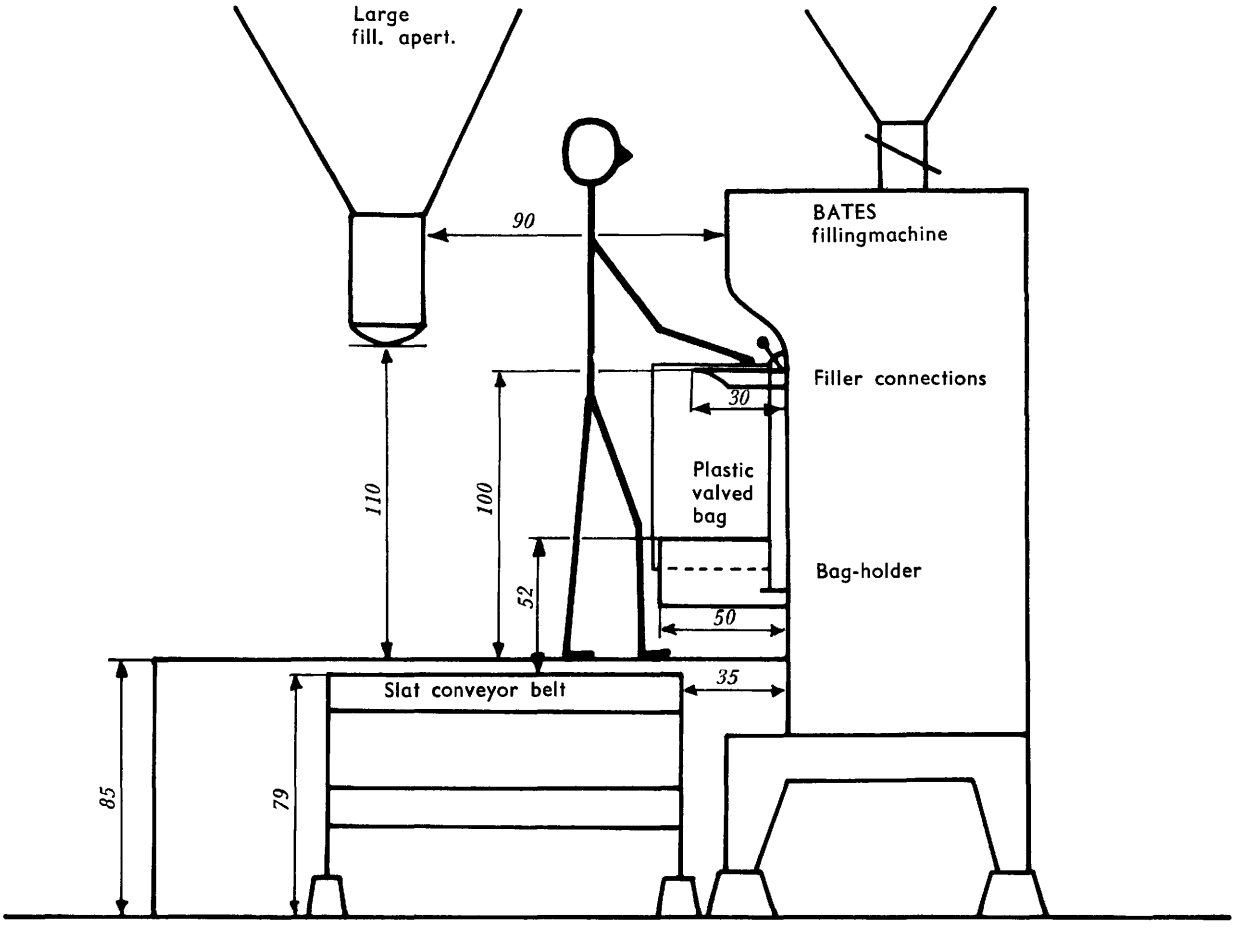
Dimensions in cm Scale 1:25

FRONT VIEW OF FILLER'S WORKPLACE (WITH BATES FILLING MACHINE)



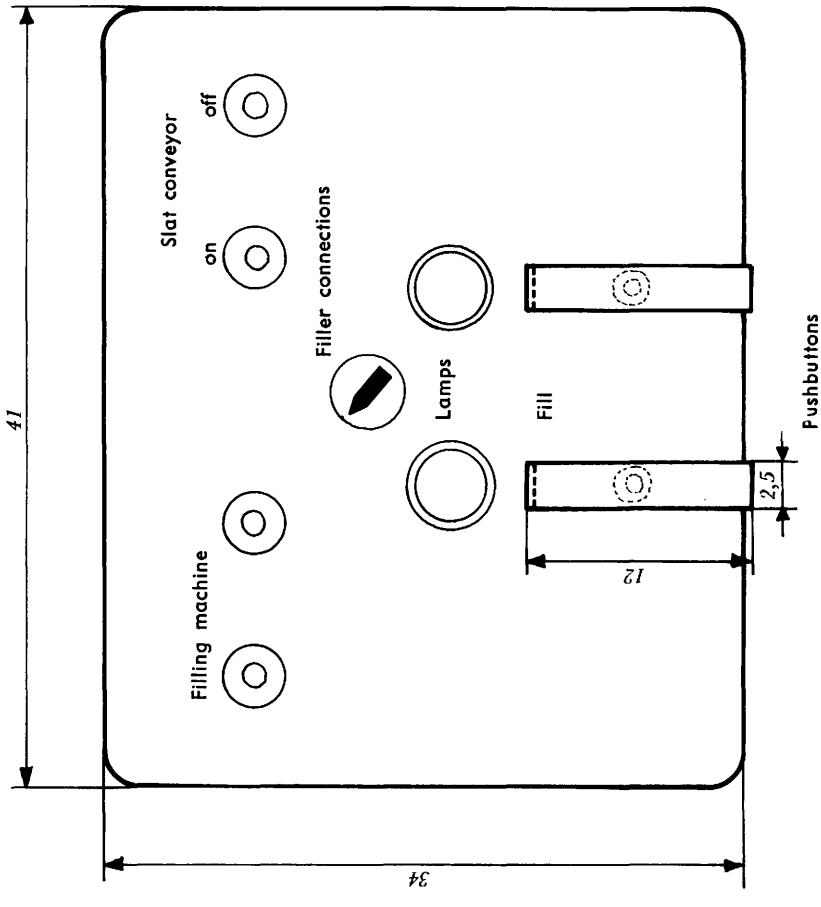
Dimensions in cm Scale 1:25

SIDE VIEW OF FILLER'S WORKPLACE
(WITH BATES FILLING MACHINE)



Dimensions in cm **Scale 1:25**

SWITCH BOX ON BATES FILLING MACHINE



Scale 1:4

Annex V-5

Works	Department	Workplace/Duties	Date
S.B.B.	Loading	Filler (with Bates filling machine) Nos. 9 and 10	April 1968

Criteria for the assessment				Remarks
VISION	Close by	Empty bags on table	1	
		Opens bag valve	2	
		Filler connection Ø 8 cm	3	
		Operating lever 12 x 2 1/2 cm	(4)	
			5	
	Far off	No requirements	1	
			2	
			3	
			4	
			(5)	
	Colours	None	1	
			2	
			3	
			4	
			(5)	
Hearing		No requirements	1	
			2	
			3	
			4	
			(5)	

Annex V-5-a

Muscular strength	Upper limbs	With left hand takes bag from table With right hand grasps bag With left hand opens valve With right hand fits valve onto filler connection With left hand presses operating lever	1 2 (3) 4 5	Distance : ± 10 cm Distance : 30 or 50 cm Height : 124 cm
Movement	Lower limbs	Works standing, sometimes in sitting position Governed by site Climbs four steps to platform	1 2 (3) 4 5	
Posture	Back	Works standing or sitting	1 2 3 4 (5)	

Annex V-5-b

Use of hands	Grasps (empty) bag with left and right hand Opens valve with left hand With left hand presses down operating lever	1 2 (3) 4 5	
Staying power	Every 6 to 8 seconds takes a bag from table and slip on Presses down operating lever	1 2 3 (4) 5	
General	Regularity of operation of slipping on bags	1 2 3 (4) 5	

Annex V-5-c

Lighting difficulties		1	
	No daylight	2	
	Neon lighting	3	
		4	
		(5)	
Noise		1	
	No hampering noise from filling	2	
	machine	(3)	
		4	
		5	
Vibration		1	
		2	
	Still to be measured	3	
		4	
		5	
Climatic conditions		1	
	Inside work	2	
		3	
		4	
		(5)	
Dust		1	
	Still to be measured	2	
		3	
		4	
		5	
Respiratory irritation		1	
	Still to be measured	2	
		3	
		4	
		5	
Skin irritation		1	
	Not known	2	
		3	
		4	
		5	
Toxic substances		1	
	Still to be measured	2	
		3	
		4	
		5	
Type of shift		(1)	
	Alternating shifts : morning,	2	
	afternoon, night	3	
		4	
		5	

Annex VI

Job description - Sealer

Location of workplace

The workplace is situated alongside slat conveyor belts 310 and 311 at a distance of ± 1 m from the Bates filling machine (see Annex IV-1).

Process

The plastic bags, open at the top, are filled by means of the large filling aperture. They are then carried on the slat conveyor belt to the sealing machine, where the upper edge is sealed tight. They then move on to the sewing machine at which, if necessary, the outer jute bags are sewn up. The bags then pass the check-weigher's workplace where they are regularly checked for weight. Belt 312 (see Annex IV-1) carries the bags further. Finally they arrive, via further conveyor belts, at the wagon or lorry where they are stacked. When use is made of the large filling aperture, the sealing machine is always used.

The sealer

The sealer must pass the upper edge of each bag through the slit in the sealing machine (see Annex IV-1). The bag stands upright on the slat conveyor belt. The sealer grasps the bag by the two upper corners, raises the upper part of the bag, which contains no product, and folds it to squeeze out air. Air in a bag causes difficulties during stacking. Throughout these activities the sealer holds his arms outstretched.

Annex VI

Folding is carried out with a twisting movement of forearm and wrist. After folding, the sealer again draws up the upper part of the bag and passes it with thumb and forefinger through the slit in the sealing machine. With thumb and forefinger of the left hand he grasps the bag firmly (up to just below the beginning of the slit) until the upper part of the bag is gripped by the machine and the bag is carried along further. To ensure a satisfactory seam the slat conveyor belt must move at the same speed as the sealing machine.

There are two sealing methods :

- sealing with tape,
- sealing without tape.

Where a tape is dispensed with, only the side walls of the bag are sealed together at the upper edge. Where tape is used, an extra plastic tape is welded over the seam. Whether use is to be made of plastic tape depends on the type of product; dusty products such as NPK and KAS are sealed with plastic tape. Part of the sealer's job is to insert the roll of tape and to replace it as necessary with a fresh one.

Actions performed by the sealer :

- Grasps filled bag at upper corners
- Pulls out upper edge taut
- Folds unfilled part of bag (upper edge)
- Draws out edge straight again
- With thumb and forefinger feeds upper edge of bag into sealing machine slit.

Annex VI

Preparations

When the sealing machine is to be used in a particular shift, the previous shift switches on the machine. The correct temperature is also set as the heating elements take about 30 minutes to reach the operating temperature.

At the beginning of the shift the sealer tests the quality of the seam, using an old bag for the purpose. The seam is inspected by the sealer and foreman as follows :

- they check for adhesive strength and for any bubbles or unevenness in the seam;
- after the seam has cooled, they open it up again to test its adhesive strength.

If necessary, the sealer can adjust the temperature after these checks have been carried out. He must not, however, make any adjustments to the machine, this being the fitter's job. Should any trouble arise during loading, the sealer calls for the foreman and/or fitter.

Description of workplace

A "seat" was rigged up for the sealer next to the slat conveyor belt. It consists of :

- a jute bag filled with sawdust (± 10 cm thick)
- a sort of wooden stool 76 cm high
- a wooden stand 18.5 cm high.

The seat is located in front of the guard plate of the emergency switch. Total height : 104.5 cm (see Annex VI-2).

Annex VI

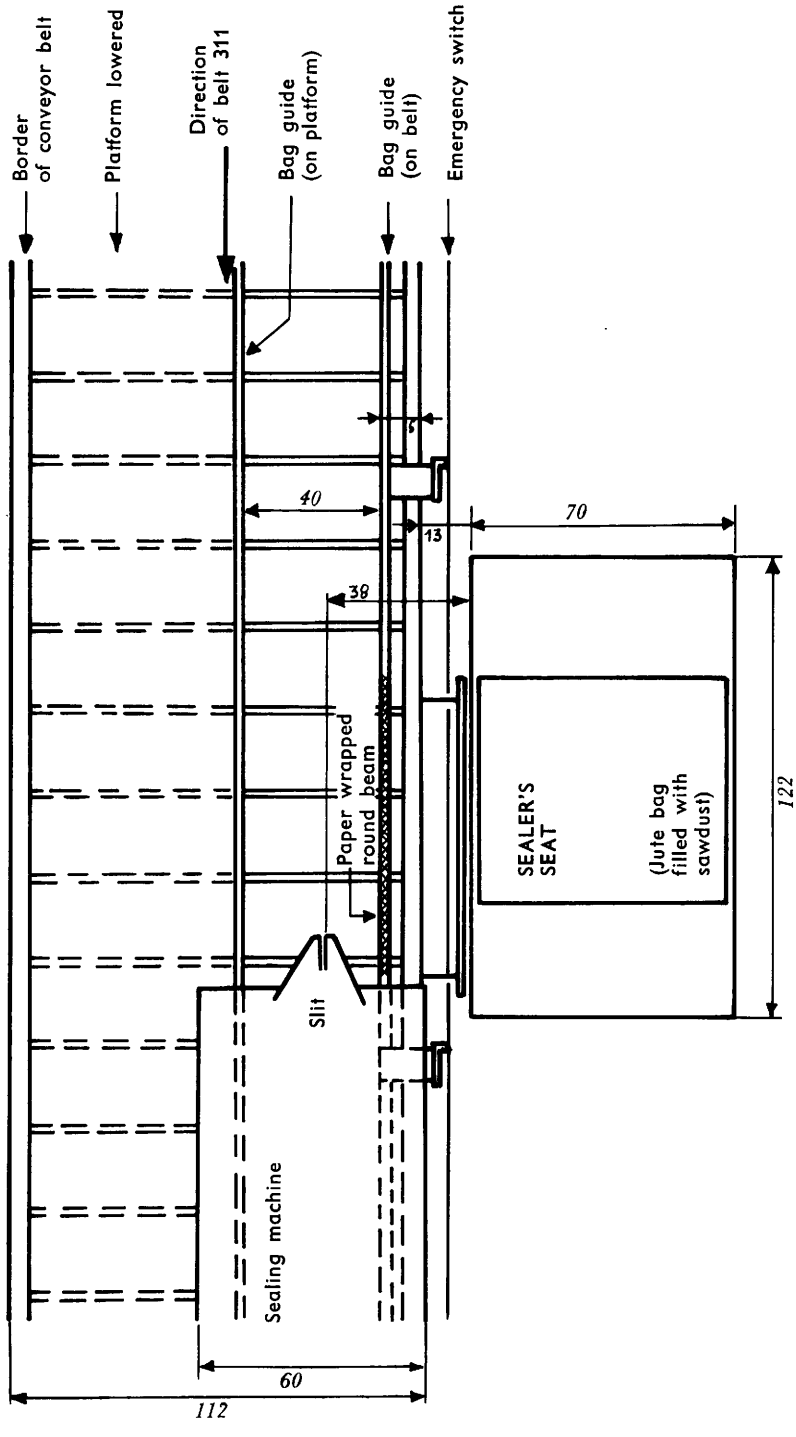
The slat conveyor belt is 78 cm high, so that the sealer can work seated. The difference in level between seat and belt is 26.5 cm. In front, however, the sealer has very little room and must therefore spread out his legs with his knees pressing against the guide beam. To protect the knees part of this beam has been wrapped in paper. The feet rest on the 5 cm wide border of the conveyor, and as the sealer must spread out his legs wide and the border is so narrow, he splays his feet at an angle of about 90°. The thighs are not horizontal, the knee being held higher than the pelvis. The back is constantly bent forwards towards the belt (see Annex VI-2). The working posture assumed by the sealer is somewhat unnatural.

The situation with the 76 cm high wooden stool applies to the workplace at belt 311. At belt 310 an empty 50 cm diameter oil drum has been placed on the wooden stand in front of the emergency switch guard plate. The seat was raised and made "comfortable" by piling on it discarded plastic bags.

Notes

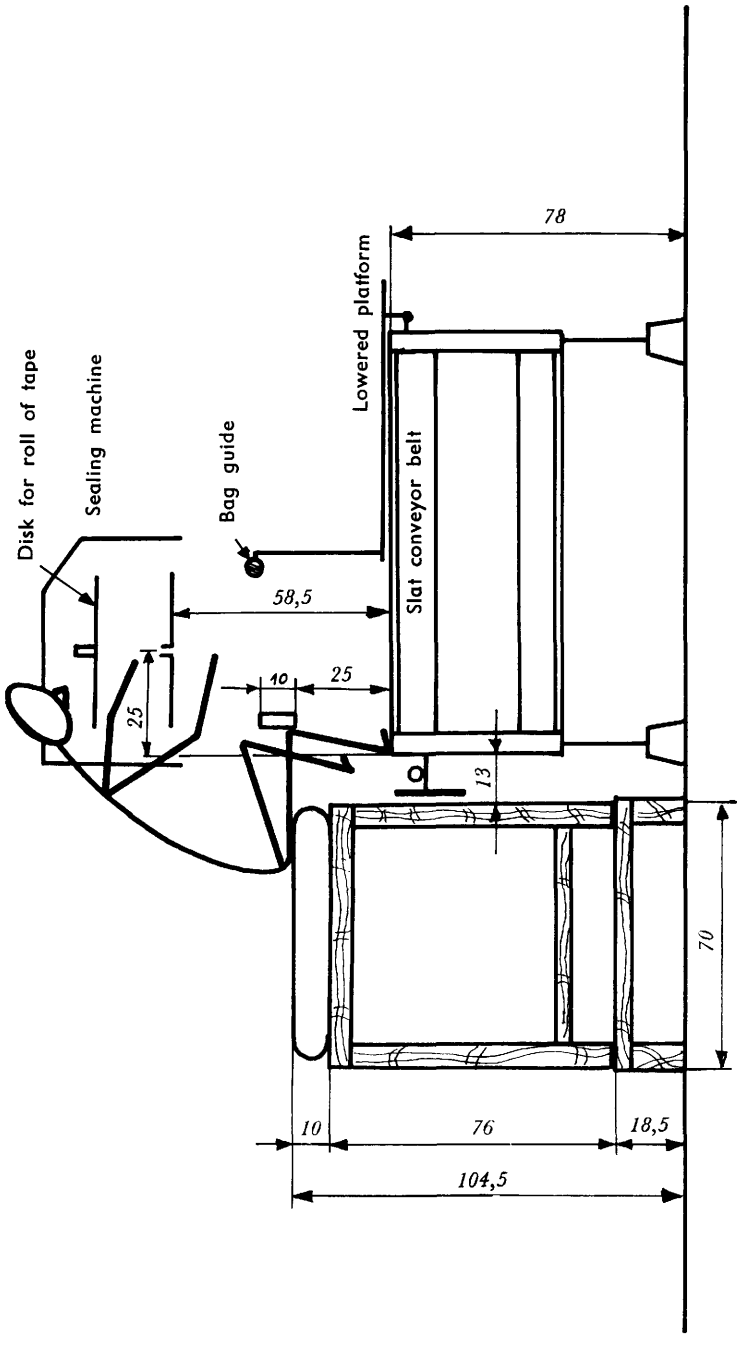
- No room for legs and feet
- Arms are constantly held out towards the front
- Fingers are always grasping bags
- Unnatural working posture
- Back constantly bent
- Complaints (by sealers) : swollen forearm muscles and pain in the wrist.

PLAN OF SEALER'S WORKPLACE



Dimensions in cm Scale 1:20

SIDE VIEW OF SEALER'S WORKPLACE



Dimensions in cm Scale 1:20

Annex VI - 3

Works	Department	Workplace/Duties	Date
S.B.B.	Loading	Sealer	April 1968

Criteria for the assessment				Remarks
V I S I O N	Close by	Air bubbles and uneveness in seam. Scale of thermoregulator. Bag seam in line with the sealing machine slit. When inserting a fresh roll of tape : roll, roll guide and clamp.	1 2 (3) 4 5	Scale graduation : 2,5 mm. Figures : 5 mm. The device is switched on by the previous shift because the operating temperature is reached only after half an hour. The foreman checks the first (trial) seam.
	Far off	Nothing special. Distance between sealing machine and filling machine 2.35 m.	1 2 3 4 (5)	
	Colours	Nothing special. If necessary at the beginning of the shift in the case of the trial seam : if temperature too high, seam burnt (black).	1 2 3 4 (5)	
Hearing		Nothing special.	1 2 3 (4) 5	

Annex VI-3-a

Muscular strength Movement posture	Upper limbs	Grasps upper edge of bag with both hands. Draws out taut. Folds so as to squeeze air out of sack. Draws out straight.	1 2 (3) 4 5	Bag width about 51 cm. Distance between sitting surface edge and sealing machine slit : 38 cm.
	Lower limbs	Works sitting. Legs always spread out, knees pressed against guide beam. Feet turned out on border of slat conveyor belt.	(1) 2 3 4 5	Unnatural posture.
	Back	Works sitting. Back bent forward, no back support.	(1) 2 3 4 5	The difference in height between the sitting surface and the sealing machine slit is 32 cm.

Annex VI-3-b

Use of hands	Grasps upper edge of bag and draws corners apart with both hands. Folds upper edge of bag in drawn-out position. With thumb and forefinger introduces bag edge into sealing machine slit (with both hands). Sets wheel of thermoregulator with thumb. Fits roll of tape into roll guide and clamp (thumb and forefinger).	(1) 2 3 4 5	
Staying power	Works sitting. Draws out bag upper edge straight and folds. Frequency : for ± 20 minutes one bag each 6 seconds. Interruption of ± 5 minutes while wagon is rolled away.	1 2 3 (4) 5	Dependent on size of wagon
General	Responsible for quality of seam, check at beginning of shift. Worker does <u>not</u> subsequently see the sealed bag again.	1 2 3 (4) 5	

Annex VI-3-c

Lighting difficulties	No daylight. Neon lighting.	1 2 3 4 (5)	
Noise	Running filling machine is no hindrance.	1 2 (3) 4 5	
Vibration	None.	1 2 3 4 (5)	
Climatic conditions	Inside work.	1 2 3 4 (5)	
Dust	From open bag. Still to be measured.	1 2 3 4 5	
Respiratory irritation	Still to be measured.	1 2 3 4 5	
Skin irritation	Not known.	1 2 3 4 5	
Toxic substances	Still to be measured.	1 2 3 4 5	
Type of shift	Alternating shifts : morning, afternoon, night.	(1) 2 3 4 5	

Annex VII

Job description - Check-weigher

Location of workplace

The workplace is situated at the head end of belts 310 and 311 (see Annex VII-1). It is bounded at the rear by belt 312.

Equipment

Check-scales (1 unit, make : Jan Molenschot - year of manufacture 1957), 1 desk, 1 shovel (for topping up underweight bags), 1 support on belts 310 and 311, 1 emergency switch, 1 light signal box.

At the workplace there is also the ladder leading to the platform on which stand the Libra and Molenschot scales (see Annexes VII-1 and VII-2).

The space available is restricted by the presence of cables and tubing, the drive for conveyor belt 311 and a frame post arranged on the right next to the check-scales (see Annex VII-1).

Process

The product is carried from the bunker to the Libra scales. These weigh 50 kg of product in $\pm$ 8 seconds. This quantity is carried into the intermediate bunker to Bates filling machine (abbreviation : BV) 9 or 10. At the filling machines the product is bagged. At the time the study was being carried out the packing consisted of a plastic inner bag and a jute outer bag. Filling was carried out with the large filling aperture. Belts 310 and 311 convey the filled but still open bags to the sealing machine, where the plastic inner bag is sealed. The bags then move on to

the sewing machine where the jute outer bag is sewn up. The bags, which stand upright from the moment they leave the filling machine, are now tilted over. They then pass the support near the check-weigher, who in each case checks one of every 20 to 25 bags.

The check-weigher

The check-weigher checks bags for weight. In general the weight must be 50 kg but at the time the study was being carried out it stood at 50.6 kg (= gross weight). Weight tolerance : 0 to 100 g. It appears that bags do not have a constant weight. Should wide deviations occur several times running on the same scales, the check-weigher must adjust the Libra or Molenschot scales in question. Deviations from the correct weight are recorded on a check card for each bag weighed.

Underweight bags are topped up if the deviation is excessive. This can be done when packing is in the form of valved bags.

The check-weigher also has to remove damaged bags from the belt and dump them empty on the grating on the ground. If the number of damaged bags is too high, this job is assigned to additional personnel. When use is made of the sealing machine, the check-weigher must stuff the plastic waste from the cartons by the sealing machine into a sack.

Preparations

At the beginning of the shift the check-scales are calibrated with weights lying on the ground alongside the scales. At the rear of the

scales the check-weigher has access to the balance mechanism (see Annex VII-3). The narrow space makes it difficult, however, to get behind the scales. Calibration of the check-scales is carried out a number of times during the shift. At the same time at least two bags weighed on each of the Libra scales and on the Molenschot scales are checked at the beginning of the shift to see whether their weight lies within the tolerance limits. If necessary, these scales are adjusted at the very beginning of the shift. The Libra and Molenschot scales are set on overweight. The degree of overweight depends on the type of product. The foreman assists with these last checks.

Information

It is essential for the check-weigher to know whether a bag comes from the lefthand or righthand scales of a particular filling machine. When valved bags are being employed, the weigher looks at the filling machine to see which filler connection is at that instant in use (left or right). As the filler connections are always used in turn, every second bag on the belt (counted from the filling machine) comes from the same filling aperture, i.e. from the same set of scales. The check-weigher therefore always counts bags in pairs so that he can follow the sequence and know to which Libra scales the bags belong. If the large filling aperture is used, a light signal informs the check-weigher on which Libra scales the bag was filled (see Annex VII-4). For this purpose a signal box comprising four lamps is fitted above the desk: one lamp for each of the Libra scales and one for the

Molenschot scales. The lamps burn continuously throughout operations. Should a bag drop off the filling machine, the lamp pertaining to the scales on which the bag was filled goes out. The check-weigher then counts the bags in the same way as for filling with valved bags to ascertain from which scales the bag arriving on the support has come.

The lamps are not arranged in a logical way. Looking at the filling machines, one sees BV 10 on the left and BV 9 on the right. On the signal box the BV 10 lamps are below and the BV 9 lamps above (see Annex VII-4).

It would surely be more logical to fit the BV 10 lamps on the left, so that on looking at them one would also see filling machine BV 10 on the same side. Similarly, the BV 9 lamps ought to be on the right.

It remains to be decided which lamp ought to be fitted above and which below. The clearest arrangement would be if the lamp for the most distant set of scales was fitted above. If the box were turned about, then the lamps would be arranged in the same pattern as the scales to which they belong.

Actions performed by the check-weigher

- Watches lamps
- Counts bags from filling machine to support (see Annex VII-8)
- Draws bag towards him onto support

- Picks up bag
- Lays bag on check-scales
- Sets balance mechanism by throwing over lever (see Annex VII-5)
- Reads off deviations (see Annex VII-6)
- Locks balance mechanism by throwing lever back
- Picks up bag
- Carries bag to support alongside belt
- Pushes bag onto belt between other bags
- Records deviation on check card
- If deviation lies outside tolerance limits, checks further bags from the same scales
- If necessary, adjusts Libra and Molenschot scales (see route in Annex VII-2).

Working times and rest periods

Working time depends upon the total quantity of product loaded on the route. It may happen that someone is assigned to different workplaces during a shift. As already mentioned, one of every 20 to 25 bags is checked; this corresponds roughly to a rate of 1 bag every 3 minutes.

Fixed rest periods : 15 minutes per shift, in the morning shift from 11 to 11.15 h. Brief breaks also occur, for example when a wagon is being filled or some disturbance occurs. Wagon changes take about 5 minutes, during which the check-weigher cleans up his workplace.

Annex VII

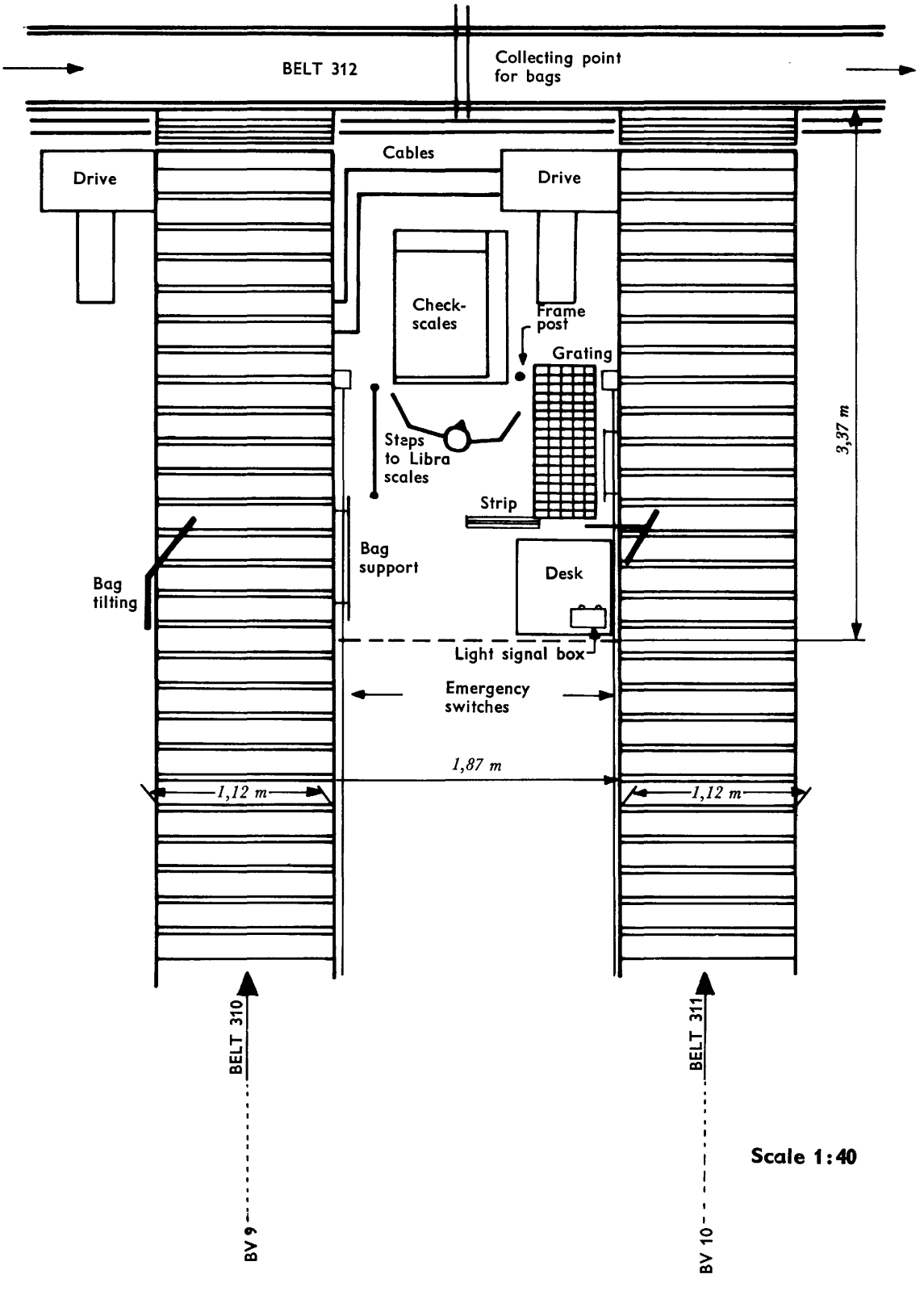
Causes of deviations in weight

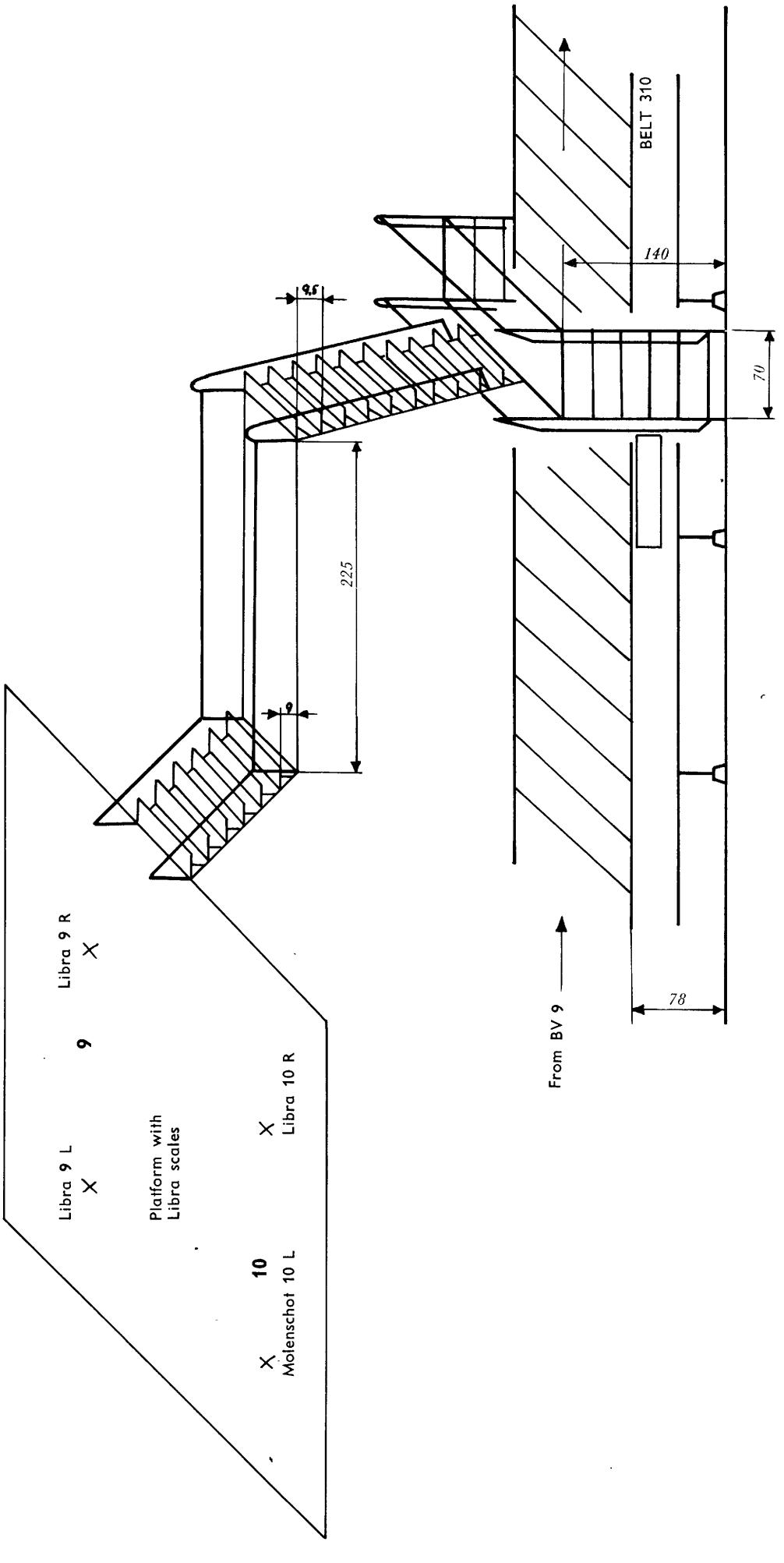
- Product adhering to scale pan (at present fairly rare owing to PVC lining)
- Dust in product
- Bunker almost empty
- Mechanical troubles in Libra scales caused by wear of knife-edges, springs, stops, etc.
- Product adhering in bunker between Libra scales and filling machine
- Disalignement of conveyor belt in filling machine (product then falls alongside the bag)
- Inaccurate setting of scales.

For both the Libra and the Molenschot scales the following are important factors for weight :

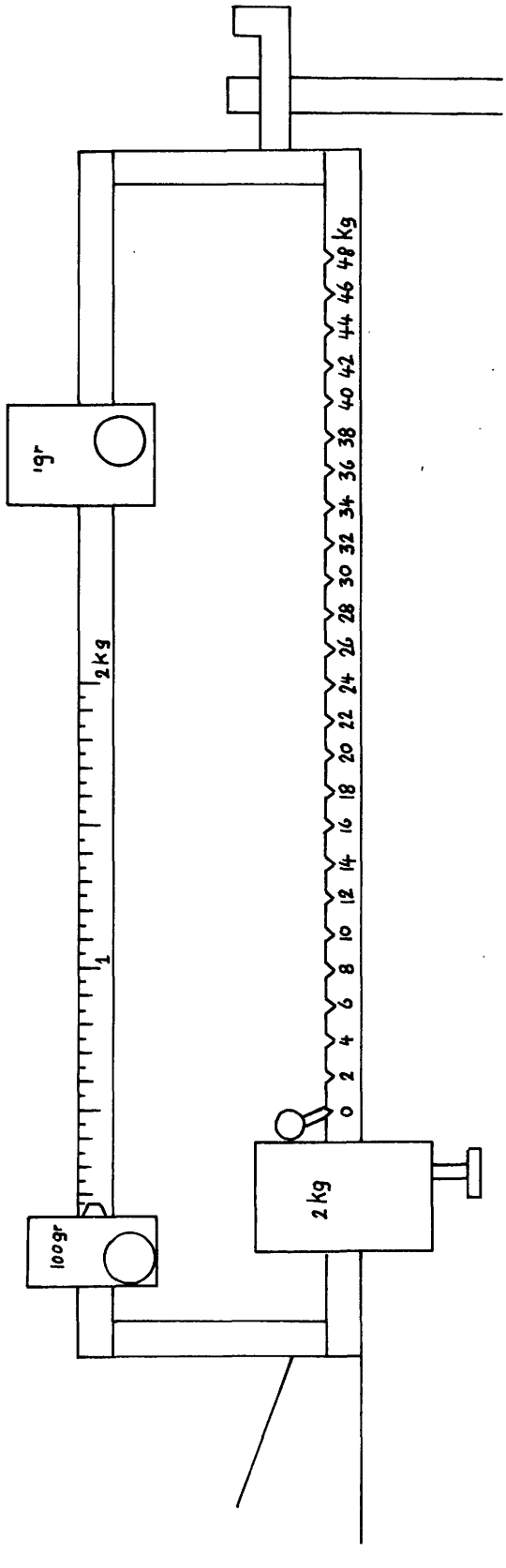
1. the counterweights (see Annex VII-6)
2. the slide (see Annex VII-7).

PLAN OF CHECK-WEIGHER'S WORKPLACE





ROUTE FROM WORKPLACE TO LIBRA SCALES



SCALE GRADUATION OF MOLENSCHOT SCALES (CHECK-SCALES)

situated behind balance mecanism

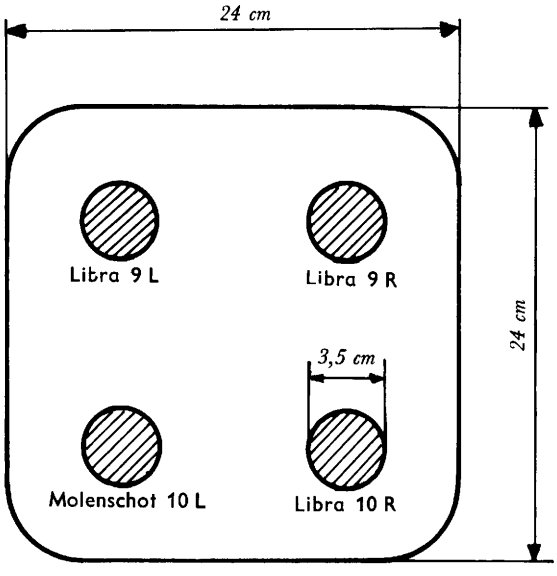
and needed for calibration

Scale 1:2

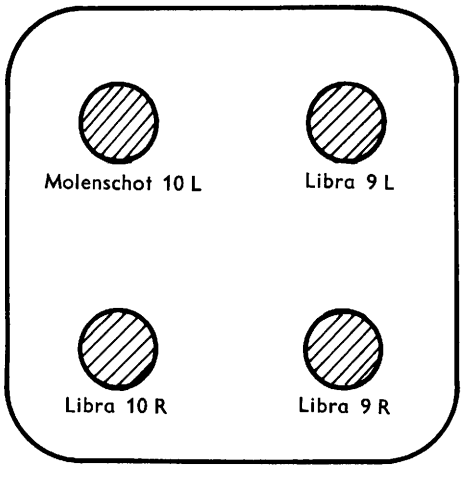
LIGHT SIGNAL BOX

1. Present arrangement of lamps

2. Improved layout of lamps



1. Present arrangement of lamps

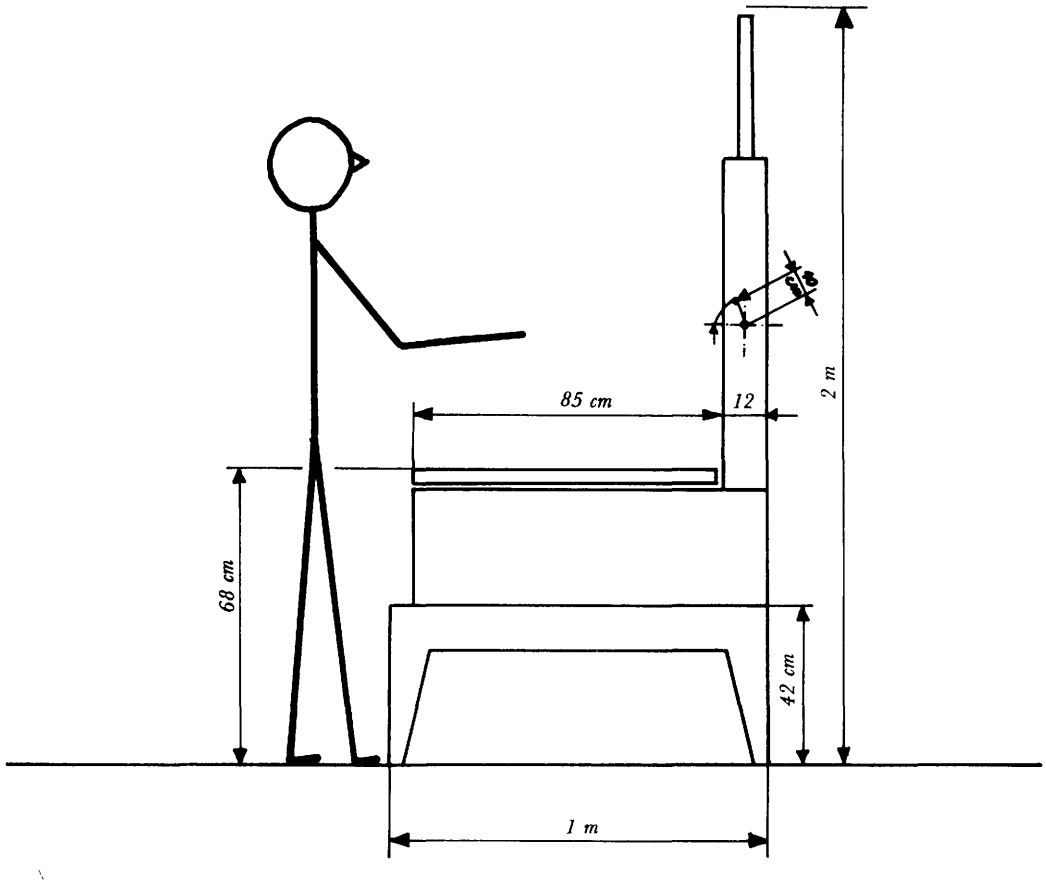


2. Improved layout of lamps

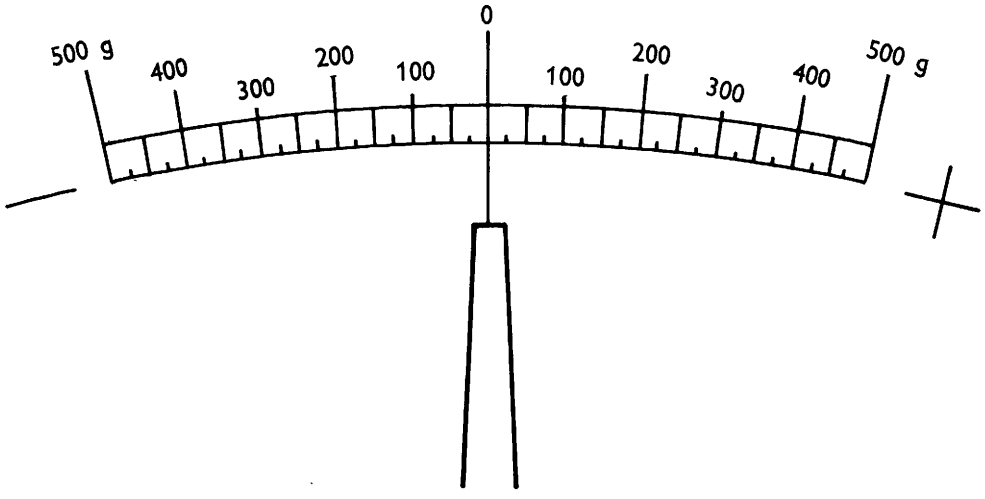
Note:
Box needed for loading with large filling aperture

Scale 1:4

SIDE VIEW OF CHECK-SCALES



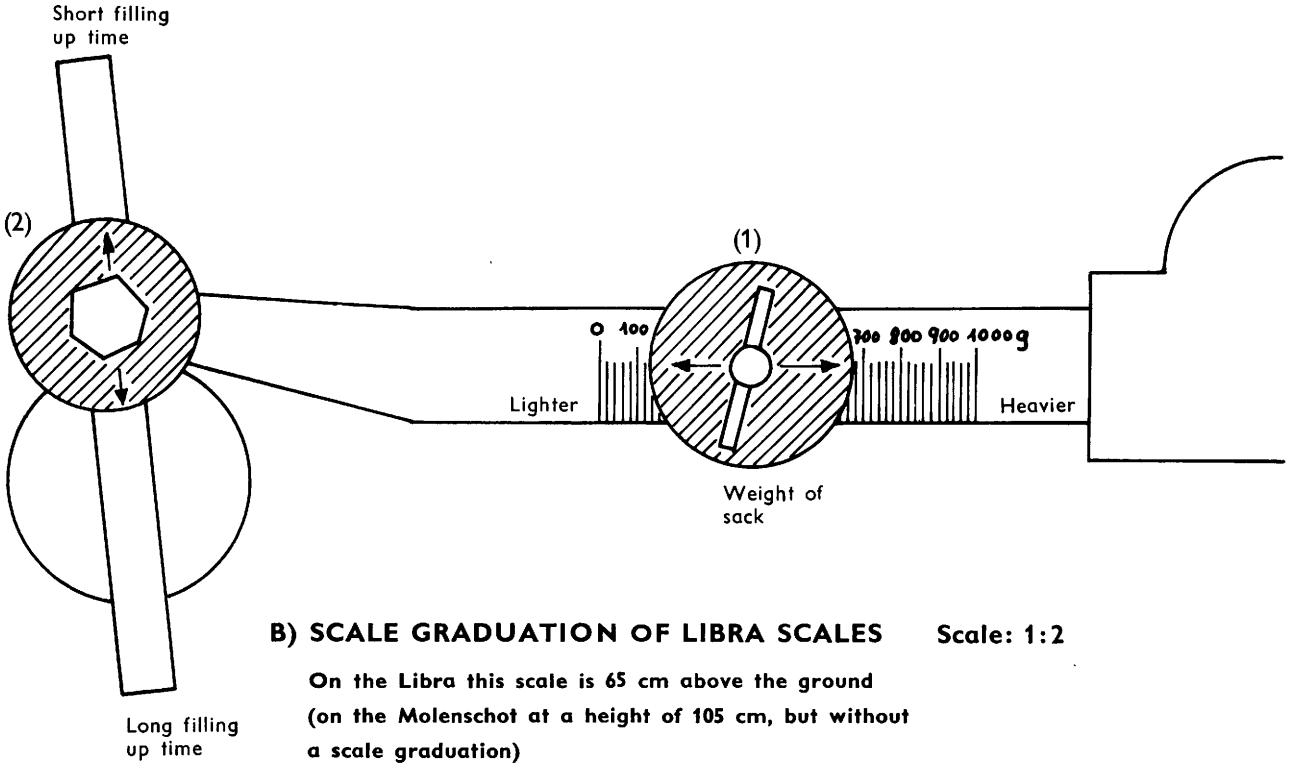
Scale 1:20



A) SCALE GRADUATION OF CHECK-SCALES **Scale 1:1**

Make: Jan Molenschot

Year of construction: 1957

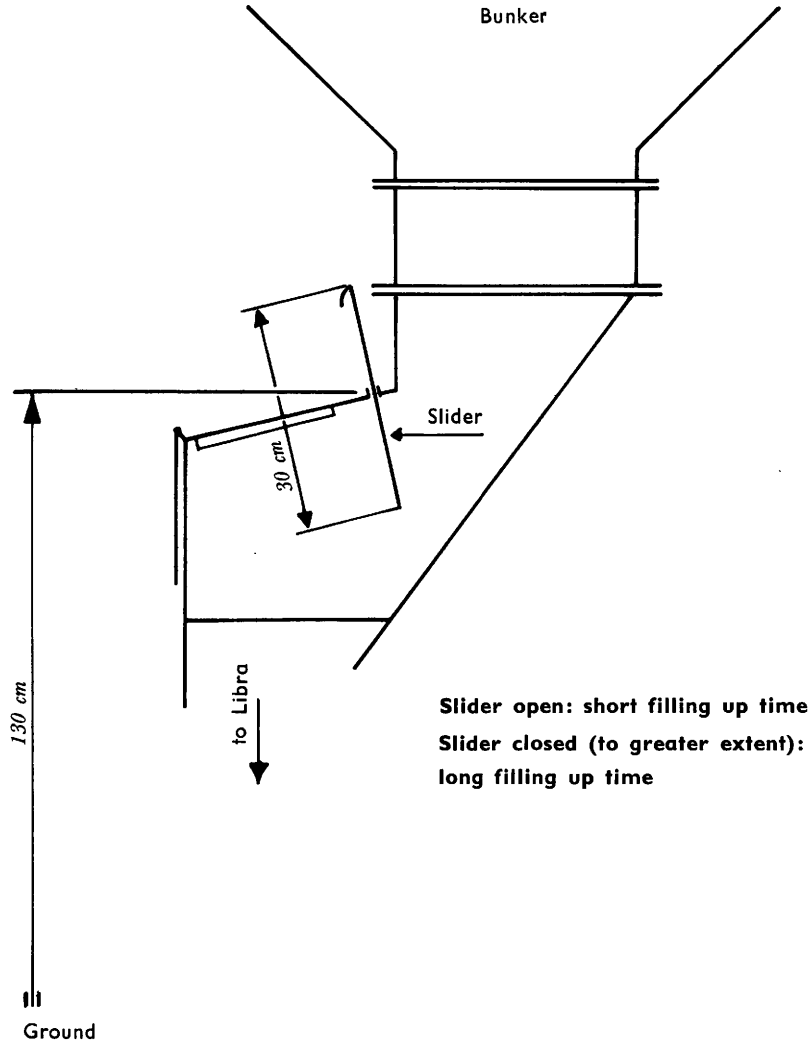


B) SCALE GRADUATION OF LIBRA SCALES **Scale: 1:2**

On the Libra this scale is 65 cm above the ground (on the Molenschot at a height of 105 cm, but without a scale graduation)

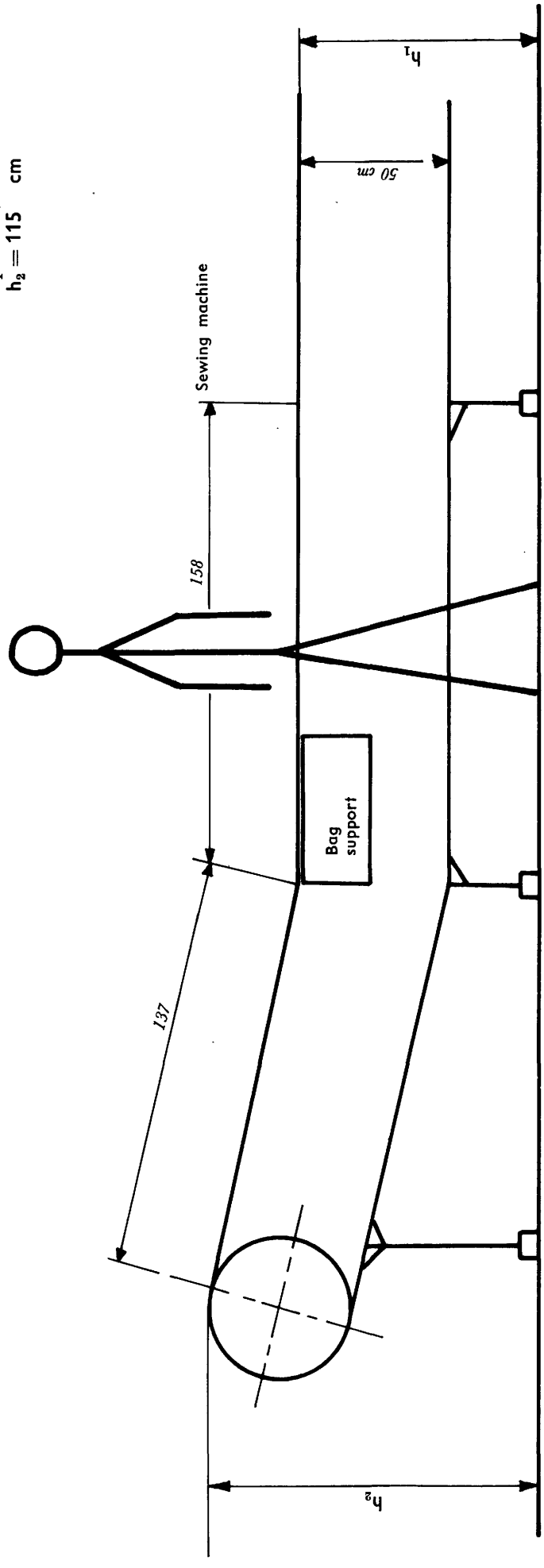
SLIDER BETWEEN BUNKER AND SCALES

(Libra or Molenschot)



Slider open: short filling up time
Slider closed (to greater extent): long filling up time

Scale 1:10



SIDE VIEW OF SLAT CONVEYOR BELTS 310-311

Scale 1:20

Annex VII-9

Works	Department	Workplace/Duties	Date
S.B.B.	Loading	Check-weigher	11.3.1968

		Criteria for the assessment		Remarks
V I S I O N	Close by	Red lamps on/off, Bags. Scale graduation of check-scales 2,5 mm. Scale graduation of calibrating balance mechanism in mm. Scale graduation of control slide (Libra weighing machine) in mm. Records discrepancies in weight. Obstacles at workplace. Damaged or badly sealed or badly sewn bags.	1 (2) 3 4 5	
	Far off	Filling machine. Filled bags, to count off whether they come from righthand or lefthand scales.	1 2 3 4 (5)	
	Colours	Red lit lamps.	1 2 3 4 (5)	
Hearing		Communication with immediate surroundings.	1 2 (3) 4 5	

Annex VII-9-a

Use of hands	Grasps 50 kg bags	1	
	Grasps 25 kg weights	(2)	
	Pulls over handle of scales	3	
	Thumb and forefinger for adjusting balance mechanism and scales (during calibration)	4	
	Holds on when climbing ladder and steps	5	
	Tops up underweight bags with shovel (very few)		
Staying power	Lifts and carries 50 kg bags for weight check	1	
	Carries bags with corrected weight ± 6 m	(2)	
	Works standing	3	
	Climbs ladder and steps to adjust scales	4	
	Cleans workplace while wagon moves away	5	
General	Climbs ladder 140 cm	1	according to instructions 1 out of 10
	Ascertains whether bags come from lefthand or righthand scales	2	
	Keeps bags within the permissible overweight (0 to ± 100 g)	(3)	
	Checks one of every 20 to 25 bags	4	
	At beginning of shift, 2 or 4 bags in succession for checking balance mechanism and scales	5	
	Calibration of balance mechanism with 25 kg weights		
	Removes damaged or badly sealed bags from conveyor belt		
	Coarse filling and topping up at scales crucial for bag filling time and for regularity of filling		

Annex VII-9-b

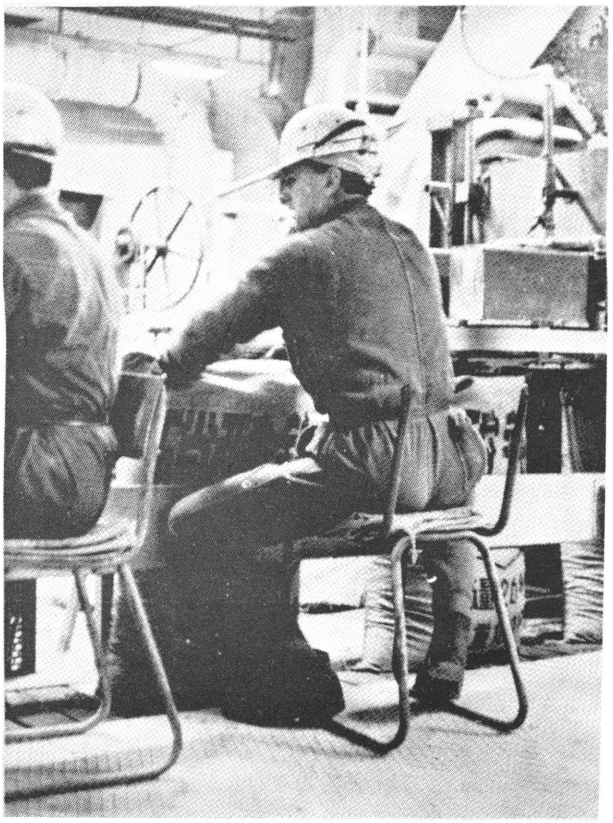
Muscular strength	Upper limbs	Grasps 50 kg bags 2 arms Pull from belt - push 2 arms Lifting bags 2 arms Laying on scales 2 arms Pulling bags straight on belt 2 arms Carrying bags 2 arms Actuating lever in front of sealing machine 1 arm Placing two 25 kg weights on scales 1 arm Calibrating scales 1 arm Transferring waste (plastic bags) from sealing machine from box to sack 2 arms	(1) 2 3 4 5	
Movement	Lower limbs	Works standing Moves backward and forward between belt and scales (with bag) Moves from scales to filling machine Climbs ladder with six steps Climbs flight of 10 + 6 steps Bends below the belt (during cleaning)	1 (2) 3 4 5	2 to 3 steps : ± 6 m
Posture		Handles 50 kg bags Works standing Bends down during cleaning Bends down during checking and adjustment of scales Lays down bag in bent-over position and lifts from scales Pulls ans pushes bags on support alongside conveyor belt	(1) 2 3 4 5	

Annex VII-9-c

Lighting difficulties	No daylight. Neon lighting. Little light on the scale graduation on the scales (front and rear)	1 2 (3) 4 5	
Noise	Running filling machine, sealing and sewing machines. Must speak a little louder to make oneself understood. No hindrance.	1 2 (3) 4 5	
Vibration	None	1 2 3 4 (5)	
Climatic conditions	Inside work	1 2 3 4 (5)	Summer temperatures
Dust	Still to be measured	1 2 3 4 5	
Respiratory irritation	Still to be measured	1 2 3 4 5	
Skin irritation	Not known	1 2 3 4 5	
Toxic substances	Still to be measured	1 2 3 4 5	
Type of shift	Alternating shifts : morning, afternoon and night	(1) 2 3 4 5	

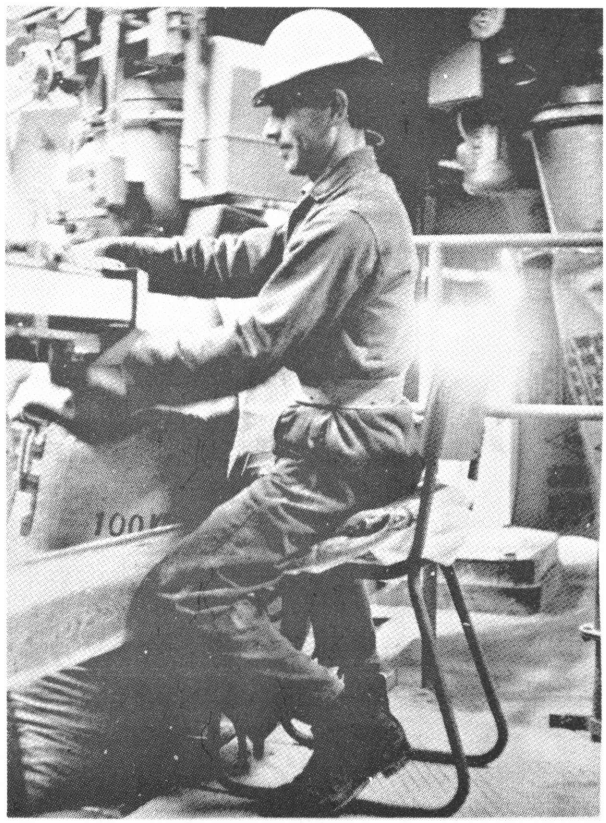
Filling of bags

Hampered by pillar. Must let the weights, which hang just as high as the filling aperture, pass by before he can slip on the bag. Just as the weights are going by the operator drops briefly to his knee and twists to the left so as to be able to devote as much time as possible to slipping on the bag.



Bag folding

Even after the back of the chair had been repaired he would make no use of it as it would mean that he would be sitting too far away. No room for the feet which are supported on the side of the chair. Sits with feet splayed out because he has no knee roo. Under existing conditions another possibility would be to bend forward and extend his reach.



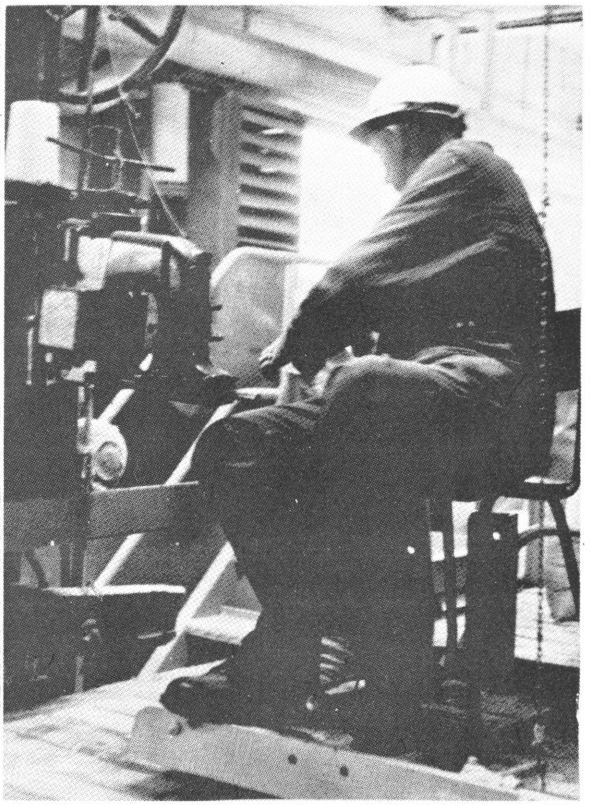
Operating sealing machine

Seating level raised with packing material so that the right arm does not have to be raised above shoulder level during work. Makes no use of chair back.

No room for feet which are supported on the side of the chair.

Splays out the legs as otherwise there is no knee room. Under existing conditions another possibility would be to bend forward and extend his reach.

Annex VIII-4

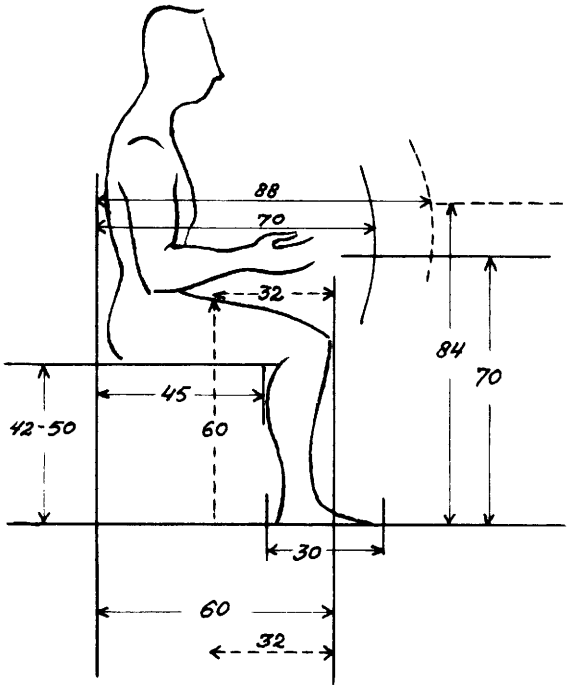


Operation of sewing machine

Sits parallel to slat conveyor belt.

Works with back twisted and bent forward because of the low working level and inadequate knee space.

Has to work sewing machine pedal with the left foot in order to have adequate scope for movement with twisted back.



	Optimal dimensions	Actual dimensions
Work level	70	84
Seat height	45	32
Seat length	42 - 50	60
Reach	46 - 70	88
Foot support	30 x 40	between chair legs
Knee space	60	32

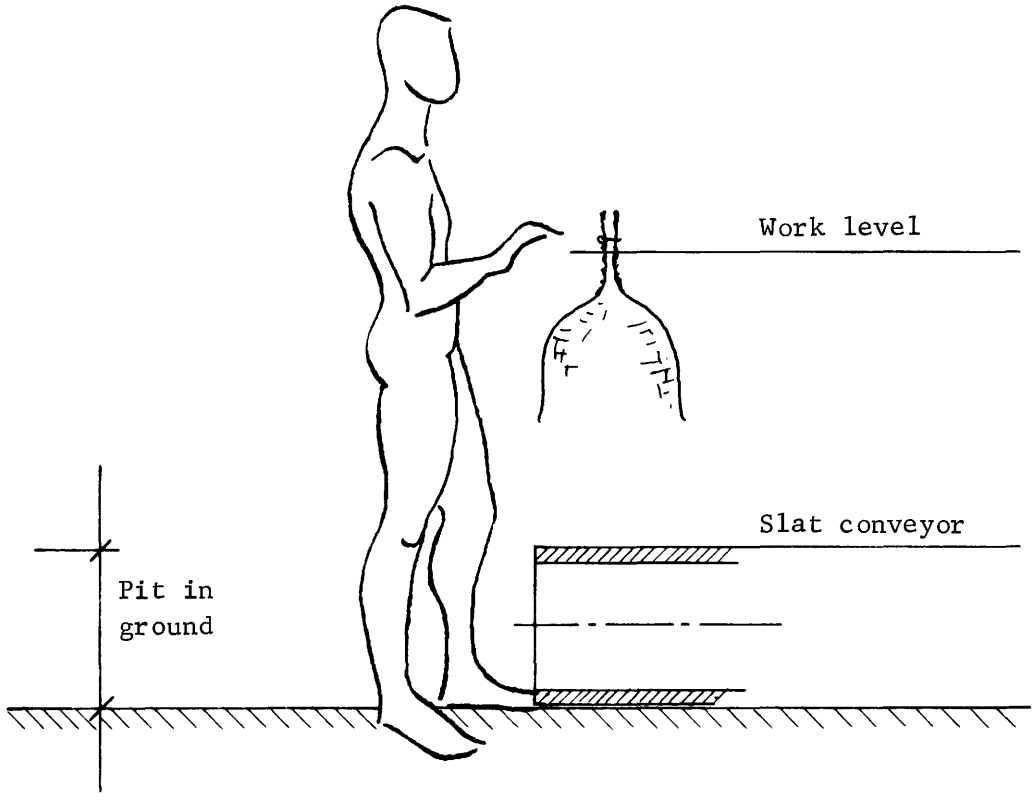


Fig. 4 - Pit in ground to enable bags to be worked on while standing.