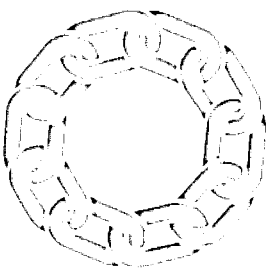
Commission of the European Communities

Information Bulletin of the Steel Industry Safety and Health Commission



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Notice

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Accidents*

1. EOT crane

The fitter and an apprentice had been detailed to check the hoist coupling pins and rubbers on the overhead cranes; they had also been instructed to check the brake shoes and adjust as necessary. The accident occurred in a foundry bay serviced by three cranes. They completed work on one of the end cranes. The apprentice then remained on the working platform of that crane whilst the fitter went into the crane cab and drove the crane towards the middle crane. Their tackle was then transferred from the working platform of the end crane to the working platform of the middle crane. The apprentice crossed onto the middle crane and the fitter then drove the end crane to its access platform at the far end of the bay. Meanwhile the apprentice drove the middle crane to its own access platform. The fitter returned to the middle crane via its access ladder. The power was switched off and both men climbed onto the top of the crane to carry out the required work. This completed, the fitter instructed the apprentice to climb down into the crane cab and move the crane towards the third crane in the bay on which they were to work. Once in the crane cab, the apprentice turned on the power and began to move the crane slowly. He heard a crash and saw that the fitter was slumped on top of the crane cab his body hanging partly through an upper access hatch. The crane had been moved approximately 15 ft. The apprentice summoned help and the fitter was freed but was found to be dead on arrival at hospital.

Investigations and conclusions

Investigations showed that the fitter had sustained fatal injuries as a result of his head being trapped between an isolator box on the top of the middle crane and a roof support beam. In order to carry out the job assigned to him it was unnecessary for the fitter to move the crane although it might have been necessary to test the hoist or the cross travel mechanism. He had apparently decided to move the crane in order to transfer himself and his equipment to another crane. This unorthodox practice had apparently been adopted by maintenance fitters and electricians prior to the accident without the knowledge or approval of their supervisors. It was, and is, specifically forbidden in the rules governing such work.

There was an isolator switch on the working platform but the deceased did not have sufficient time in which to operate it.

Recommendations/action

1. Personnel will not be permitted to stand, or work, on the top of an EOT crane whilst it is long travelling.
2. If personnel are undertaking maintenance work which will place them in a position of danger from the movement of the crane on which they are working, or from the movement of other cranes in the bay or adjoining bays, then the correct isolation procedures must be agreed and implemented.
3. All jobs which require personnel to ride on EOT cranes will be identified and safe working procedures for such jobs will be prepared and implemented. These procedures will ensure that personnel are in safe positions.
4. Trapping hazards, related to the movement of all EOT cranes to be identified as a matter of urgency.
5. A permit to work system incorporating a purpose designed document to be introduced.
6. The removal, or reduction in height, of equipment on working platforms of EOT cranes to be undertaken where practical. Any remaining hazards to be clearly marked and appropriate warning notices posted.
7. The rule prohibiting persons under 18 years of age being trained as crane drivers to be extended to include apprentices.
8. The training of apprentices to be examined, particularly with regard to training for crane driving and instruction in safe working procedures and practices.
9. A time limit and order of priorities to be agreed for the implementation of the above recommendations.

2. Handling with a fork-lift truck

A metal cabin (3.21 m x 1.54 m x 2.55 m), which was on the floor between two sheds in the area inaccessible to the overhead travelling cranes, had to be moved by a few metres by a team of two fitters in order to bring it within reach of one of these cranes.

To this end, a fork-lift truck was brought up and the forks inserted under the cabin. Because of the cabin's width and bulk, its top had to be lashed to the top of the truck's mast.

One of the two men was therefore on the roof of the cabin, to which a lug had been welded to provide an anchoring point for a rope. The other workman was standing on the control panel of the truck between the mast and the roll-over bar in order to assist with the lashing.

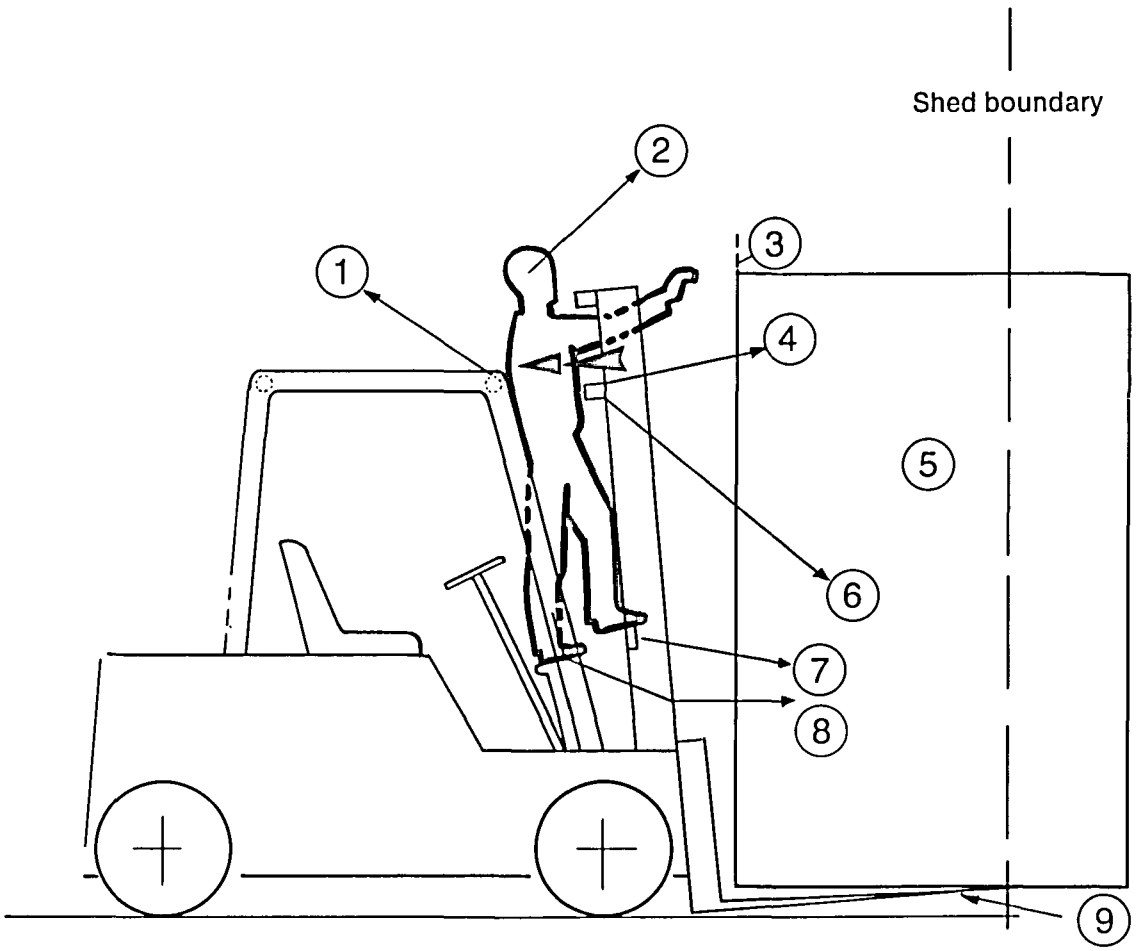
He had put one foot on a cross-bar of the mast and reached out to take hold of the rope. As he was performing this movement, or returning to his previous position, the other foot touched the control lever which caused the mast to be raised towards the roll-over bar. His thorax was thus crushed just below the heart between the bar and the mast and he died on his way to hospital.

Measures taken

1. The regulations were revised and drawn to the attention of operators.

* The Editorial Committee of the Bulletin draws the attention of readers to the fact that the preventive measures described in accident reports are those which were taken or decided upon by the works where the accident occurred.
They may relate to particular circumstances and/or to regulations and practices which are not necessarily the same in all countries.

2. Fork-lift trucks were fitted with a windscreen (and wipers, since the trucks are also used outside the sheds) in order to ensure that if, in breach of regulations, operators do climb onto the cross bars they cannot touch the controls.



1. Roll-over bar
2. Victim's position
3. Rope-attached lug welded to the cabin
4. Point of crushing
5. Cabin to be moved
6. Crossbar
7. Crossbar
8. Mast control lever
9. Forks

3. Electric furnaces

Early on a Sunday morning at 0.15 a.m. while the 12t electric furnace was in operation, the person acting as foreman decided to 'push in' the scrap adhering to the furnace wall. To this end, he shut off the furnace (interrupting the electric power suply and thus causing automatic retraction of the electrodes) and had the two doors opened.

This was a straightforward and routine operation, which was carried out in accordance with the normal procedure, namely:

(i) the foreman shuts off the furnace from the control panel located at (1);

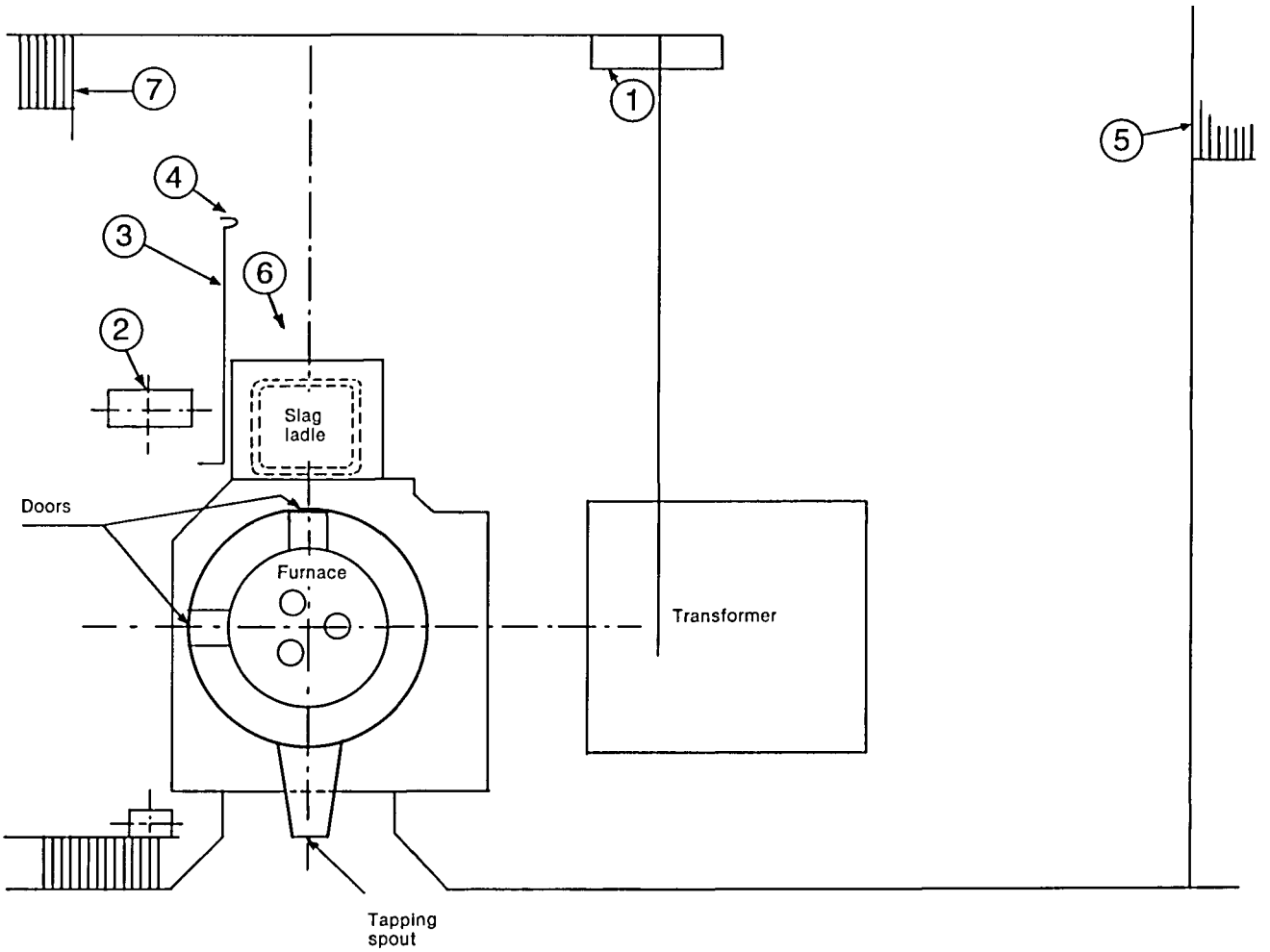
(ii) a furnace operative opens the two doors from the control station located at (2);

(iii) together with another operative, he looks through the two open doors to check whether any scrap is sticking or caught on the cylindrical internal wall of the furnace;

(iv) if this is the case, the operative takes a push-in bar lying on the floor at (3) and 'pokes' the inside of the furnace to cause this scrap to fall into the bath;

(v) the doors are then reclosed and the furnace restarted;

(vi) for these operations, the operatives must be wearing protective clothing.



In the present case, after the furnace had been shut off the doors were opened by an electrician/crane operator who was undergoing training as a production supervisor while a furnace operative bent down to pick up a bar and prepared to gush in the scrap if necessary.

It is assumed that, as soon as the doors were opened, scrap fell into the bath and there was a very violent emission of flame through the open slagging door.

The operative standing at (4) was wearing overall a helmet, goggles, an aluminized jacket/coat and gauntlets. He was burned on the face, on the back of the neck (between the jacket and helmet) and on the shoulder, mainly when the flame was deflected from the wall. He ran towards the access and escape stairs (5), and was intercepted by the foreman, who extinguished his burning clothing. He suffered burns over 4% of his body but no damage to the eyes.

The electrician/crane operator, who was at (6), suffered burns on the front of his body to the face, hands and forearms. He ran towards the access and escape stairs (7), and received assistance on reaching the bottom of these stairs. He suffered second and third-degree burns over 16% of his body, but no damage to the eyes.

The enquiry covered the operating procedures: charging of the furnace, melting and in particular the push-in, deslagging and rabbling operations.

For these operations, it is necessary to open the two doors in order to:
(i) look inside the furnace;
(ii) knock down any adhering scrap;
(iii) carry out deslagging or rabbling.

There is a risk only when workers are looking into the furnace. This risk is not eliminated by waiting before approaching the furnace in order to look inside. It is not possible to observe the inside of the furnace adequately unless the doors are fully opened.

It was decided to take the following measures. By now they have been implemented or preparatory studies are in hand.

(i) Staff to be reminded of the safety and operating instructions and work on the platform to be organized by the supervisor. 'No personnel to be in the vicinity unless absolutely essential.'

(ii) Personal protection
Staff to be reminded of the need to wear protective equipment and safety clothing.
The equipment exists but it must be recognized that we have difficulty in ensuring that it is worn.
The question of wearing fireproofed overalls has been raised. For electric-furnace operation (where no metal can splash onto the platform), there seems to be no need for fireproofed overalls, which would cause extra inconvenience.

(iii) Overall protection
The possibility of using a mobile screen with observation slits or mesh has been considered. The necessary design work will be carried out and enquiries will be made at other similar plants to find out what measures are taken elsewhere and to introduce them if it seems appropriate.

4. 8m fall

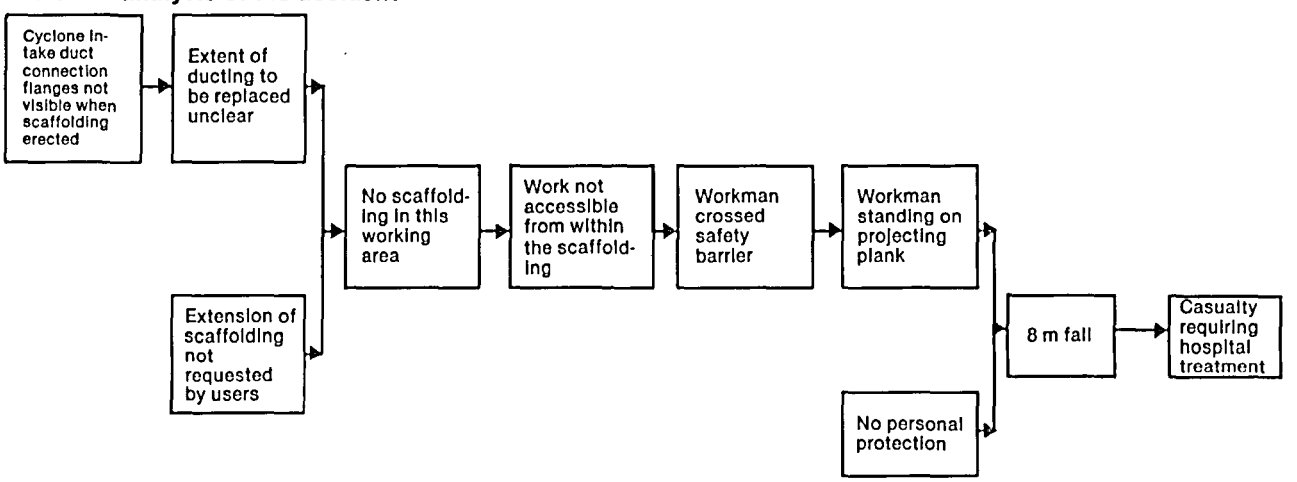
A workman was engaged in relagging a duct at a height of 40m on an installation. In order to perform his task, the workman crossed the safety barrier of the scaffolding and climbed onto two planks projecting beyond its edge. The planks tipped over and the workman fell a distance of 8m.

Results of the accident: head and spinal injuries.

Action envisaged

(i) Use of personal protection to be reconsidered.
(ii) Scaffolding to be suitable for the work to be carried out.
(iii) Personnel carrying out work at a height to be made aware of the risks involved.
(iv) Special procedures to be adopted for organizing work sites where scaffolding is used and acceptance to be carried out by the various users of such equipment.

Fault tree analysis of the accident



5. Firestarters
British Steel Corporation*

Steelmaking has many 'firestarters' in its own processes and operations. In this section, we show the main sources of fires — and the materials which most often assist in spreading the fire.

The most obvious firestarters are liquid metal, slag, hot coke, hot slabs, and so on. Equally obviously, we have to be extra careful to ensure they do not come into contact with material which burns easily and quickly and spreads the fire.

But many other fires are started by routine operations we should be able to control. Burning and welding operations, for example, have caused almost one in four of the fire damage incidents during the last few years. And burning and welding are largely under the control of the individual to follow the safety rules, specially drawn up to cut fire risks.

In the same way, problems connected with electrical equipment or friction can be cut down to size by better maintenance and by individuals paying more attention to detail.

When fire starts, the materials which can cause it to spread most rapidly are the ones we need to be most careful about. Those listed here are the main 'fire-spreaders', showing the proportion of major fire incidents in which they are involved in our works:

Oil and grease	22%
Electric cables	36%
Rubber and plastics	13%
Other flammable liquids, gases, vapours, solids	13%

We have a great many of these materials in our works — because they play a vital role in the running of the businesses.

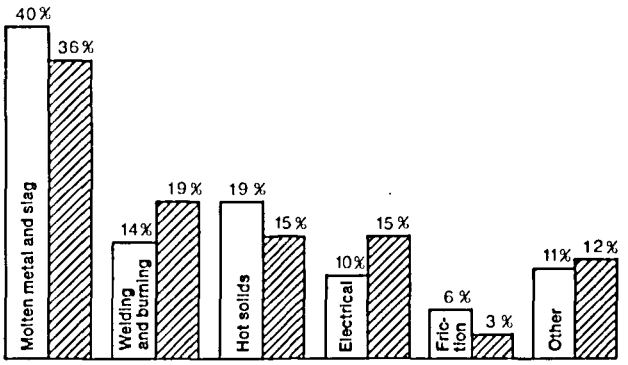
Some aspects of fire prevention can be dealt with only by proper design of plant or equipment. But in many

* Situation 1980-83 in *Safety*, April 1984.

cases, risks with existing plant can be stopped or cut by individual employees taking positive and practical action.

Positive fire prevention demands that all such materials are:
(i) used under carefully controlled conditions;
(ii) kept away from sources of ignition;
(iii) used without spillage;
(iv) cleaned up *quickly* if spillage does happen.

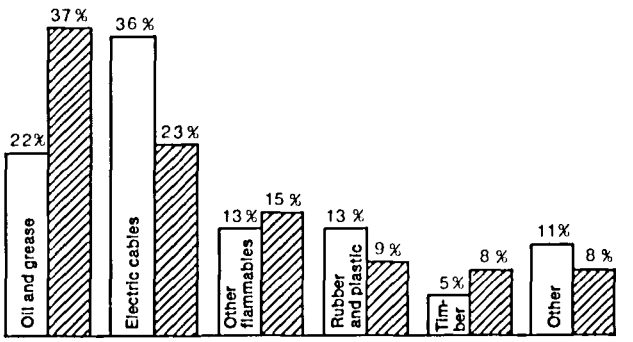
All these are safety hazards. But they are also examples of wastage, which itself costs British Steel — unnecessarily — huge amounts every year.



Firestarters

% Incidence

% Estimated total fire loss



Firespreaders

% Incidence

% Estimated total fire loss

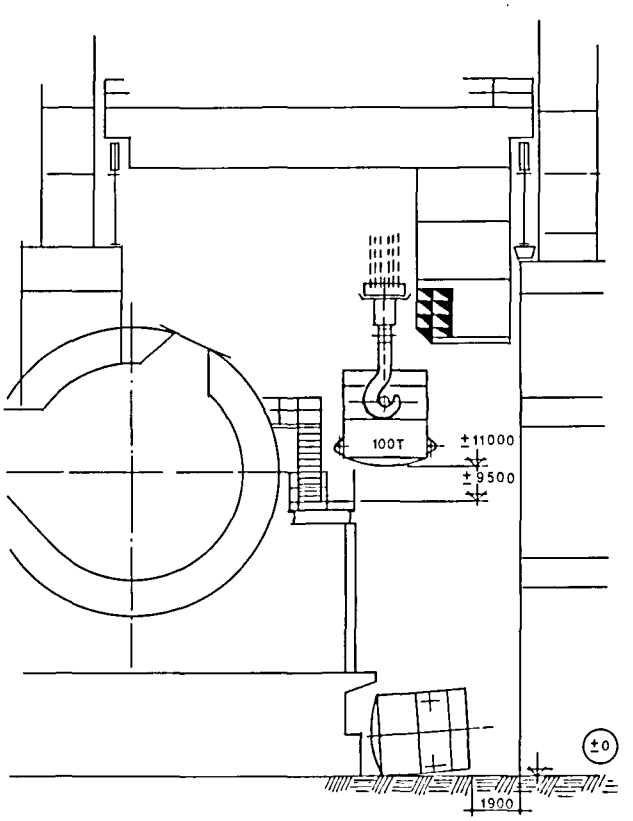
6. Killed by a falling transfer ladle

At the start of a maintenance shift an empty 100t capacity transfer ladle weighing 49.5t was lifted in the mixer building by a travelling crane equipped with a lifting beam with two flat hooks. The ladle was lifted to the level of the south platform in the mixer building (9.5m). As the foreman walked on the intermediate platform and underneath the ladle, the crane driver shifted the crab to move the ladle. At this moment the ladle slipped off the hook at the side opposite to the driver's cabin, fell on the foreman and the platform and dragged them to the ground (see diagram).

The accident was caused by the fact that one of the lugs was only resting on the point of the hook; this had not been noticed by the crane driver when the hooks were engaged (one side after another) nor by the victim who had been asked by the crane driver if the hook was properly engaged. The victim was standing in a position where he could only see the hook from the back, i.e. edgeways on, and did not notice what had happened.

Measures taken

1. The special directives for engaging lifting gear hooks in the ladle lugs and checks to be carried out are being tightened up.
2. A TV camera to help the crane driver to see objects obscured from view (second lug) is being tested.



3. The possibilities of fitting a device to indicate whether the lugs are fully engaged at the base of the hook (electrical contact load cell, pressure detector, etc.) and to give the crane driver a signal confirming proper engagement is being effected.
4. The shape of the hook point will be modified to increase the opening and facilitate engagement without entailing any loss of strength or risk of disengagement when the ladle is tipped.

7. Fatality caused by a part blown off during a pressure test on a hydraulic lifting device

A cylinder of an hydraulic lifting device with a leak at the seal of its lower end cover had been returned to the workshop to be repaired. After replacing the faulty seal, the workmen were carrying out a leakage test with a test rig consisting of an oil reservoir, a compressed-air volumetric pump with a pressure limiter on the delivery side, an isolating gate and a T-piece with a pressure gauge. The seal plugs of the lower and upper parts of the cylinder had been replaced, on the side opposite the oil inlet, by 3/4"G/1/8"G reducers, onto which were screwed special fittings, which are standard parts used for bleeding the cylinder or fitting a pressure gauge. When the pressure was at 300 bars, the special fitting on the upper section of the cylinder was suddenly blown off as a workman was passing nearby and struck him at the base of the neck.

The enquiry and the pressure tests carried out on these special fittings indicate that the most likely cause of the accident was that the part was over-tightened, perhaps with an unsuitable spanner, and its thread damaged.

Action taken

1. Compliance with the following recommendations:
   (a) The various parts should be fitted in the order in which they are normally tightened. In the case in point, the 3/4"G/1/8"G reducer must be tightened before the special fitting.
   (b) The appropriate flat or polygonal standard spanners for the parts to be tightened should be used. Adjustable spanners should not be used on small-diameter threads.
   (c) During hydraulic testing of a cylinder, the part not being tested should be completely drained before any pressure is applied.
   (d) The pressure ratings of the various accessories on an installation should be carefully checked against the service or testing pressures.
2. The fitters' department will issue short notes with a commentary on the most important basic safety rules to be obeyed when working on hydraulic or pneumatic equipment.

8. Falling coil at the banding station

The tables for the coils which are to be banded are set in the shop-floor concrete and consist of flat bars forming a V-shaped cradle in which the open coils rest. The bars are spaced at regular intervals through which the bands can be passed. The coils are deposited and removed from these tables by lifting trucks with a handling boom. All these operations are carried out with the coil axis in the horizontal plane.

The sequence of operations is as follows:

(i) A lifting truck places the coil to be banded on a table, reverses to withdraw its boom and then returns to the shop.
(ii) The bander fastens the coil with bands passed through its centre (usually three) and occasionally adds one or two bands passing round the circumference.
(iii) The truck returns to pick up the banded coil by inserting its boom through the centre, raising the coil and reversing.

The accident occurred during this last phase of picking up a banded coil. As the coil was being raised, it slipped off the boom and fell over, striking the bander's legs.

Causes of the accident

(i) The boom had probably not been inserted far enough into the centre of the coil.
(ii) There was grease on the whole of the coil and since there was heavy rain on the day of the accident the boom was wet. It was therefore easy for the load to slip.
(iii) As it fell, the coil struck the end of the table on the side to the bander. This may have contributed to its tipping over.

Action taken

(i) The truck drivers were reminded of their instructions and given refresher training.
(ii) The length and height of the banding tables were altered to ensure that the coils could not tip over if they fell directly onto the table.
(iii) The tables and banding equipment were moved to allow the banders more room between their work station and the shop wall so that they can escape more easily in the event of an incident, e.g. overharsh braking of a truck, brake failure, misjudgment when delivering and picking up the coils.

9. Filter cover blown off at natural gas pressure-reducing station

Before the resumption of work at a bloom reheating furnace, one of the persons in charge of the Heavy Products Department asked the Energy Department to change the natural gas filters.

These filters are replaced on every bypass line of the pressure-reducing station upstream of the 15/3-bar reducing valve.

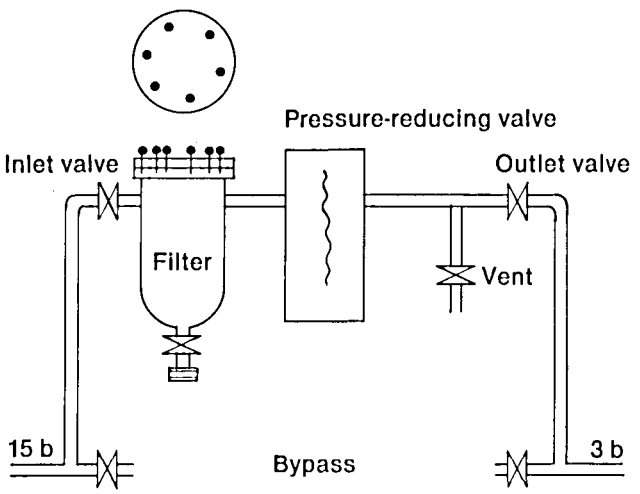
The pressure-reducing station had been isolated when the furnace was taken off gas a month earlier, with the installations shut down in accordance with the established operating procedure, i.e. with the inlet and outlet valves locked in the closed position and the vent between these two valves open.

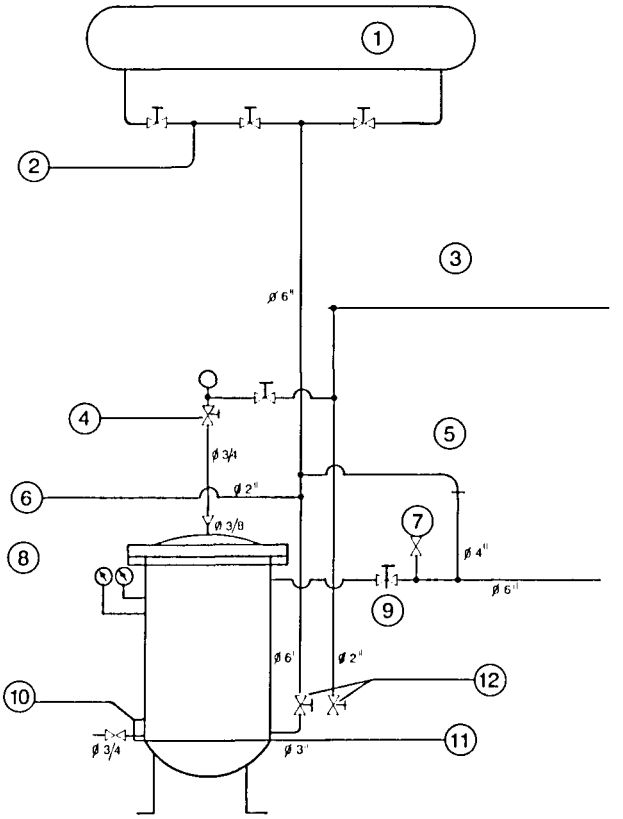
In the section of line on which the filter was located, however, the gas pressure remained at 15 bars, since

the pressure-reducing valve acted as a shut-off device and the valve underneath the filter had not been opened. In order to change the filter, the two workmen removed the bolts securing the cover. When only three bolts remained to be loosened, the cover was blown off the filter and out of the pressure-reducing station by the gas pressure, while the two workmen were struck in the face by a stream of dust. One operative received injuries to both eyes and facial lacerations.

Proposed measures

(i) Accident to be explained to the workforce and reminder issued about the isolation procedure.
(ii) Working party to be set up to develop means of increasing the safety awareness of the operatives.





1. Coolant
2. To oil line
3. Discharge pump back to filter
4. Valve open
5. Valve removed — connector to isolate filter from circuit
6. To air/oil pressure tank
7. Pressure gauge
8. Pressure gauges (entry/exit)
9. Valve closed
10. Inspection port
11. Valve open — oil discharged to tank via hose
12. Valves closed

10. Oil filter cover torn from its mountings

A foreman, two mechanics and two basement workers were repairing the oil filter for the lubrication system for the bearings of a five-stand cold-rolling mill.

The filter, which is of the rotary type is located in the oil reservoir. As it had not been working properly, it had not been in service for 10 days and several cursory examinations had produced no means of repairing it. It was thus decided to empty the reservoir of oil, to remove the cover, which has a diameter of 870mm and was secured by 15 tie-rods, and to examine the mechanism.

One of the workers isolated the filter from the rest of the installation in service by closing the inlet and outlet valves. The reservoir was emptied by opening a 3/4" valve on the bleed pipe. As the oil was only running out slowly under gravity the foreman decided to speed up the process by having the compressed air valve opened to build up the pressure at the top of the filter and force the oil into the tank via a hose fixed to the escape pipe.

After about 5 minutes one of the workers verified that the oil was flowing freely; the cover, on which one of the mechanics was sitting, was then blown off its mountings. The mechanic was gravely injured and died the same day.

Remarks

(i) All the cover clamping bows were sheared.
(ii) The oil pressure in the tank is normally 4 bars.
(iii) The compressed air system has a pressure of approximately 7 bars.

Measures taken

(i) Amended filter emptying procedure.
(ii) Pressure on filter feed restricted to 4 bars by pressure governor.

11. Railway accident

A three-man transport team using a 300 hp light rail tractor was joining five empty wagons to a set of 13 empty wagons previously positioned on a dead-end track (length of track about 200m, on a slight bend and slope).

The guard saw that the first wagon was touching the buffer stop. After securing the set of wagons he ordered the light rail tractor to uncouple and proceed to another track.

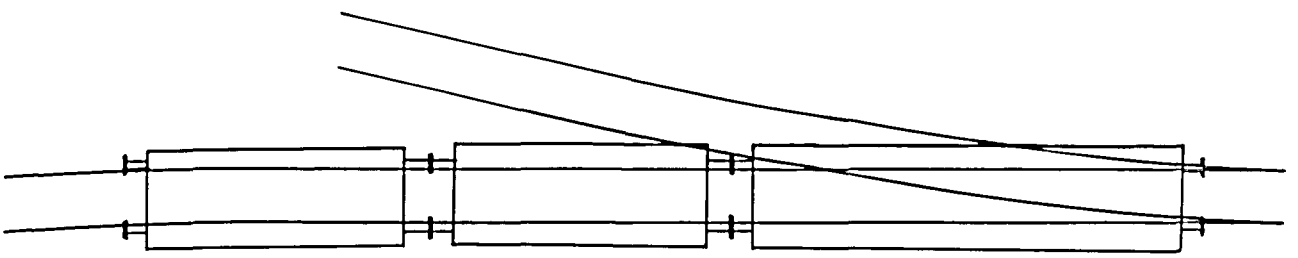
He then saw the set of wagons moving towards the points and engaging them (see diagram). At that moment another light rail tractor (600 hp) and its team arrived. The guard told the driver to clear the points by shunting the last wagon.

During this manoeuvre the wagon (light buffer) rose up, under compression, against the engine hood of the light rail tractor.

The two workers at the front of the light rail tractor were injured. One had his right leg amputated, the other suffered multiple contusions to the right leg and hip and pelvic pain.

Remarks:
The wagons were set in motion because of decompression of the buffer springs.

Measures taken
Short-term:
Refresher course for personnel on railway safety regulations.
Longer-term:
Use of computer-supplied information on the possible placing of wagons on the tracks, with on-site verification.



12. Interruption of compressed air supply to respirator

Two workers from an external firm, wearing compressed air respirators, were finishing the assembly of their scaffolding in No 6 blast furnace, around 6-7m below the gap in the shell.

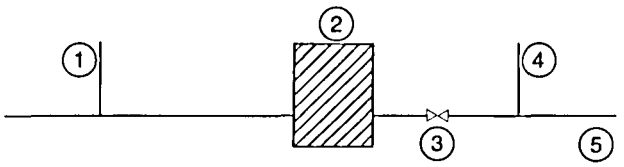
Suddenly, one of the workers realized that his air supply had been cut off, quickly took off his respirator and, with the help of the other workers, left the blast furnace using the emergency ladder. He went down to the blast-furnace platform, where he was given oxygen and recovered.

Medical diagnosis: 7% HbCO (carboxyhaemoglobin).

Remark: At the time of the incident the air around the scaffold contained 500 ppm of CO.

Explanations
(i) The blast furnace maintenance department had to change the compressed air tank supplying the taphole of No 6 blast furnace. The compressed air valve had to be shut off for this purpose.
(ii) Closing this valve caused the air supply to the worker's respirator to be cut off.
(iii) The second worker's respirator was not affected, as it was connected upstream from the valve.

Action envisaged
(a) Development of a compressed air reserve system, to which a respirator can be connected, in case of breakdown or interruption of air supply, at any point on the main circuit.
  (1) The above should be fitted with an acoustic alarm in order to alert the supervisory staff and enable them to evacuate the personnel.
  (2) Regarding (a) we can obtain a portable system which can be connected in all sections of the plant.
  The purpose of this reserve would be to permit the normal evacuation of the personnel without breathing problems.
(b) Introduction of a buffer tank with sufficient independent capacity to allow the personnel to be evacuated (as above).
  Regarding (b), a stationary buffer tank could be used where a large number of persons are employed, e.g. at the furnace top.
(c) The Committee for hygiene, safety and working conditions would like the blast-furnace section to be equipped with a 'sanitary air' network which is independent of the industrial air network.



1. Towards respirator
2. Towards taphole of No 6 blast furnace
3. Valve shut off
4. Towards 2nd respirator
5. Compressed air

13. Hook breakage during lifting operation

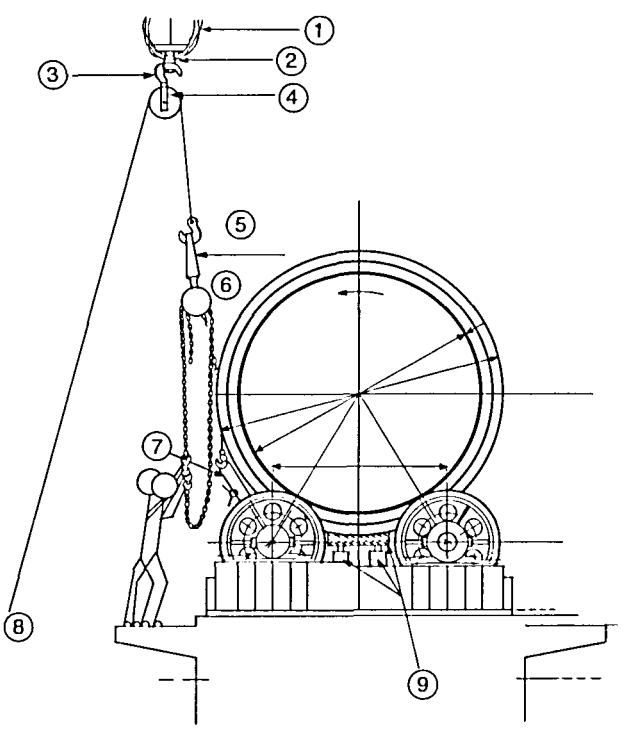
Place: Sintering plant, premixing trommel.

Operation: Replacement of a half-set of supporting drive wheels and trommel drive.

Circumstances

The revolving drum was lifted and placed on a purpose-designed cradle supported by two jacks.

The half-set of wheels (approximately 5t) was disengaged from the reduction gear side and from the second half-set of drive wheels side. It was secured by placing a double rope sling 20mm in diameter around the middle; the sling was then attached to the lifting hook, which was fitted with a safety catch, chain hoist and 8t gears.



1. Closed sling
2. Coupling link
3. Hook (3t)
4. Return pulley
5. Closed sling
6. Hoist
7. Rope (4 strands)
8. Traction rope
9. Cradle supporting trommel (2 x 50t jacks)

The hoist is attached to a cable passing over a return pulley which is itself suspended by a hook attached to the frame. The length of this cable is adjusted by a 3.5t traction rope secured to the base of a stay. This system allows the chain hoist suspension height to be adjusted to the developed length and to permit access to the chain.

When the half-set of wheels was lifted to slide it away from the drum, the weight on the chain caused the operator to call a second person to assist him.

After a few pulls the pulley and hoist fell down, injuring the shoulder of one of the men.

The suspension hook of the return pulley had broken. It was a die-stamped hook on which a rated load of 3t was embossed.

It emerged from the discussions following the accident that few people clearly understood that whilst the maximum hook load was 3t, in the case of the operation concerned the load for each leg should be limited to half this figure, in other words the maximum load should not exceed 1.5t in order to adhere to the safety standards.

Measures were taken to inform the personnel about the problems of pulleys and lifting equipment.

Every chain is only as strong as its weakest link.

14. Contact with overhead electric wire

Atmospheric conditions were bad and the temperature was very low. One litre of fuel oil per tonne was added to the ore to make wagon-emptying easier.

In order to check the state of the ore and take a sample, a worker climbed into the wagon, holding a metal bar around 3m long. Suddenly there was an arc between the bar and the overhead wire carrying 25 000 V. The worker sustained second and third-degree burns to his hands and feet.

Action envisaged

(i) Issue of a reminder that no one is allowed to climb on a wagon which is standing underneath an overhead wire.

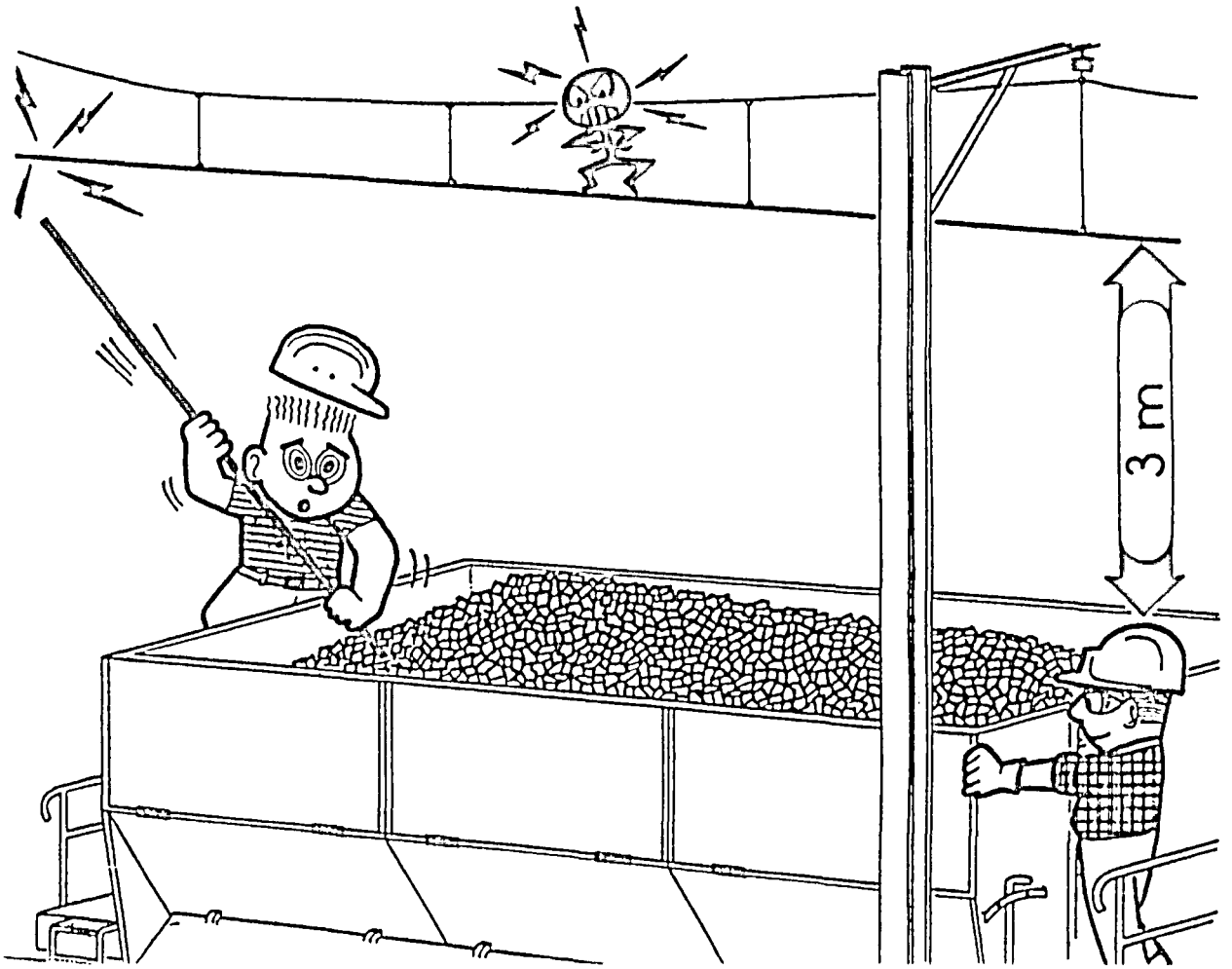
(ii) Introduction of new warning signs, including one with the text **'High voltage exceeding 1 100 V — Attention'** (See p. 10.)

15. How safety helmets can save lives

Workers were engaged in replacing a full slag ladle by an empty one underneath the platform of a blast furnace.

As they were doing this, one of the workers was struck on the helmet by a taphole drill bit and its metal extension, weighing around 20kg. The helmet was penetrated, but the worker suffered only a slight headache.

The inquiry revealed that a furnaceman had apparently checked that a slag ladle was there somewhat earlier; then, after working for a while, he had thrown the heavy piece of metal through the opening in the platform without realizing that the ladle had been taken away and that the piece of metal was likely to fall on someone's head.



Action envisaged

(i) Updating of existing regulations (in particular a ban on throwing scrap into the slag ladles.
(ii) Distribution of these updated regulations to the departments concerned and comments on the regulations.
(iii) Storing of scrap on the platform of No 1 blast furnace, with removal every two to three days.
(iv) Installation of telephones to facilitate communications between the internal transport and furnace personnel.

16. Loss of sight through failure to wear goggles

Two workers had been instructed to change the internal bearings of a roller.

Finding that the roller-axle assembly would not come out of its bracket, one of the workers took a sledgehammer and struck the base of the roller, whilst the second stood approximately 2m back and watched (without goggles).

Suddenly, following a blow from the sledgehammer, a metal splinter flew from the roller and penetrated the left eye of the worker who was watching.

Consequences: The worker lost the sight of his left eye.

Action envisaged

(i) Modifications in the design of the roller-axle assembly so that it can be removed mechanically using an extraction device or press.
(ii) Workers to be reminded that the wearing of goggles is recommended.
(iii) Introduction of a notice warning of the dangers of metal-on-metal impact.
(iv) Encouragement of the wearing of goggles, in collaboration with the safety and occupational health departments.

17. Worker electrocuted unplugging unearthed arc welding unit

A worker employed by a firm was electrocuted as he unplugged an arc welding unit from a 380 V power supply box. Another unit belonging to another firm was plugged into a second socket on the supply box.

Comments

(i) The power supply box, which was mounted on a concrete post, was fitted with two sockets and a circuit breaker with a 95-125 A thermal fuse.
(ii) The electrical installations in the section had recently been checked by an authorized body.
(iii) When the second firm's welding unit was checked, an insulation fault was found.

When investigating this anomaly, the electricians found that the cover of the fan motor terminal box, which should have been secured by three screws, had come loose and was in contact with the winding of the internal transformer and with earth.

A second check after removing this cover showed that the fault had disappeared.

Possible explanation

The short-circuit in the welding unit could have transmitted the charge to power supply box.

The electrical department checked the earth continuity and found that:

(i) the earth continuity at the supply box showed too much resistance (the supply box line was not connected to the equipotential line);
(ii) the 220 V lighting circuit for the section was earthed.

Action taken

(i) Direct earthing of the supply box (done immediately).
(ii) Removal of the earthing fault in the lighting circuit (done immediately).
(iii) Insulation of this electrical circuit from the lower BF sub-station and checking of earth continuity in this part of the circuit.
(iv) Checking and marking of all 380 V sockets in the works.

18. Near accident caused by imprecise radio message

The unit's radio network consists of a base station and N portable transmitter-receivers set to the same frequency. Messages are therefore received by all those in receive position.

On the day in question radio communication was to be used when replacing the lifting ropes of a travelling crane.

On the ground, one team was supervising the unwinding of the ropes from the drums, whilst another was controlling the winding onto the lifting drums.

At the same time a repair team was working on a trolley. The trolley control was in radio contact with the electricity sub-station.

Everything was at stop when an order to 'start' came over the radio.

The mechanics on the crane trolley passed on the order to the crane operator, who started the lifting mechanism.

This led to urgent protests from the workers supervising the unwinding of the ropes, and succeeded in halting the operation, thus preventing a serious accident.

The order, given by the sub-station and carried out by the mechanics on the travelling crane, was in fact intended for the workers on the trolley.

Such confusion is always possible when several users are on the same frequency, especially as the casual language used (start, try, up, down, stop, etc.) does not always enable the speaker to be identified.

Action proposed

A standard procedure is suggested which will work only if the users adhere to it. The principles to be followed are:

The speaker must identify himself

X calling Y
Y receiving X
message from X
Y acknowledges
X ends the communication

Measures for work under heat conditions

by G. Sonnenschein

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In the steel industry there are a number of work stations where certain working processes cause heat exposure peaks and where there is heat exposure throughout a shift. The first question the safety engineer has to ask is whether the heat exposure can be reduced by technical or engineering measures to a level wich is acceptable for workers. Only when technical measures are not viable should ergonomic/organizational measures or individual measures be taken.

Technical measures can be applied in high effective temperatures to cool the working premises or to cool specific locations and/or to reduce intense heat radiation, to screen heat radiation by reflection and absorption or to reduce it by accelerated extraction of heat.

(a) Technical measures to combat high temperatures:

(i) *Ventilation*
Adequate ventilation must be assured in hot working areas. Utilization of the temperature gradient between the air inside and outside leads to a stack effect, which can be intensified by means of suitable air intakes and openings in the roof.

(ii) *Air conditioning*
Due to the high investment and operating costs the use of air conditioning is only possible to a limited extent, for example, in control consoles and crane cabins in steelworks.

(iii) *Air jets*
These can be used to create tolerable working conditions in a limited area. The physiological benefit is derived from the cooling action caused by more rapid evaporation of sweat.

(b) Technical measures to combat intense heat radiation:
These fall into three groups, namely reduction of radiation, screening of heat radiation by means of reflection and absorption, and accelerated heat evacuation. Examples of technical methods used in the presence of intense heat radiation are given below:

(i) *Water cooling of components radiating heat*
Surface irrigation panels with open or closed circuit systems can be used to reduce heat radiation at work stations by 50% or more.

(ii) *Screening of heat radiation by reflection and absorption using glass heat shields*
Many observation and control activities in industry must be carried out in areas which are subjected directly to heat radiation, and here glass heat shields must be used. There are three types of glass heat shields on the market: absorption shields, reflection shields and reflection shields with an insulating gap. These shields are available as single, double or triple-pane configurations. Absorption shields are the least expensive and can be combined to form a twin-pane arrangement with thermal ventilation; ideally the gap should be 100mm.

(iii) *Screening of heat radiation by reflection (wire gauze)*
A wire gauze screen functions by reflecting the heat rays off the wire strands. Measurements demonstrate that the screening effect corresponds almost exactly to the closed mesh area, i.e. when 40% of the area is screened by means of wire gauze, the heat screening effect also amounts to approximately 40%. When selecting the wire gauze, a compromise has to be reached between the protective effect and adequate visibility; for the latter gauze made from wire with a rectangular cross-section is best.

(iv) *Screening of heat radiation by protective shields*
Protective shielding should have a bright metal surface (free of oil or dirt) and should not reach to the floor (which would stop circulation of air between the shield and the source of the heat rays). Mobile heat shields are particularly useful when repair work has to be carried out.

(v) *Accelerated heat evacuation using water-cooled working surfaces*
Round water-cooled platforms are for localized protection against heat and can, for example, be used in soaking pits as a working surface for furnace masons to enable repair work to be carried out in the hot furnace.

Ergonomic/organizational measures

In addition to the technical measures, which, as shown, can alleviate heat conditions to a considerable extent, ways of optimizing the working sequence should be considered, if necessary by introducing organizational changes.

This can, for example, involve a reduction in the time spent in the hot area by relocating all activities which do not require the presence of the operator in the hot area, or using tools to reduce muscular exertion. This, however, necessitates a detailed analysis of the place of work. If the conditions at the place of work cannot be improved by technical or organizational means, rest periods must be prescribed to protect the persons involved from strain and to ensure that they remain healthy. In hot areas a distinction must be made between two different types of rest period, the recovery period and the cooling period.

Recovery period

Stress and strain can be kept within tolerable limits by interrupting muscular work and introducing a so-called recovery period.

The following rules apply for recovery periods:
A large number of rest periods are more effective from the point of view of recovery than fewer but longer rest periods.

The person involved can remain in the working area where heat exposure has occurred.

Cooling period
If the heat conditions are so severe that workers cannot remain in the working area constantly, even when the muscular work is reduced, i.e. when the strain cannot be reduced to tolerable levels by recovery periods, cooling periods must be prescribed.

Cooling periods must be spent in areas where the climatic conditions are neutral or comfortable.

A minimum cooling period of 10 minutes is required.

Personal protective measures
If it is impossible to use technical and ergonomic means of protection against accidents and physical stress caused by the effects of heat at work, personal protective equipment must be used.

In the metal producing and processing industry there are many working areas in which heat protection equipment is indispensable.

The decision to use protective clothing will depend primarily on knowledge of the effects of heat rays, washing, dry cleaning, mechanical stress and metal and slag spattering, and the degree of comfort of the clothing with respect to ventilation, moisture and heat transfer.

Wearing protective clothing imposes considerable strain on the wearer, as it increases energy expenditure and the pulse rate and impairs the feeling of well-being; it is thus vital to take this into consideration when deploying personnel.

Reader's correspondence

We are grateful to a zealous reader who sent us the following item.

Stock yard

During an operation in a stock yard, involving the removal of a 25mm plate measuring 4 m x 1 100 m, a materials-handling worker was trapped between two plates.

The accident had no serious consequences but showed that something had to be done to improve working conditions.

The original method of work

A tyre-mounted crane was positioned near the storage rack. One materials-handling worker separated the plate with a crow bar and a wooden chock whereas the second one positioned the self-locking tongs on the plate and subsequently attached it to the crane hook (Fig. 1). The crane driver instructed the two workers to move away and the plate was lifted from the rack.

Changes introduced

(i) The plate storage areas have been separated from the zones entered by the workers, which consist of a walkway with access steps and railings. The storage bay is thus made up of sections into which plates are lowered separated by walkways (Figs 2 and 3).

(ii) Toothed holders have been installed in each storage rack, so that the plates can be stored next to each other but with the top edges at different heights because of the slope of the notches, and can thus be removed individually without difficulty.

Conclusions

(i) Operatives no longer enter the storage racks.

(ii) The plates are no longer difficult to separate from each other.

(iii) Plates can be removed individually with the assistance of only one worker on the ground, and he is not exposed to any risk.

If only we thought about situations before accidents happened, how many practical improvements could be introduced!

If you know of any interesting working methods which have been altered to reduce risks, please let us know about them via this bulletin.

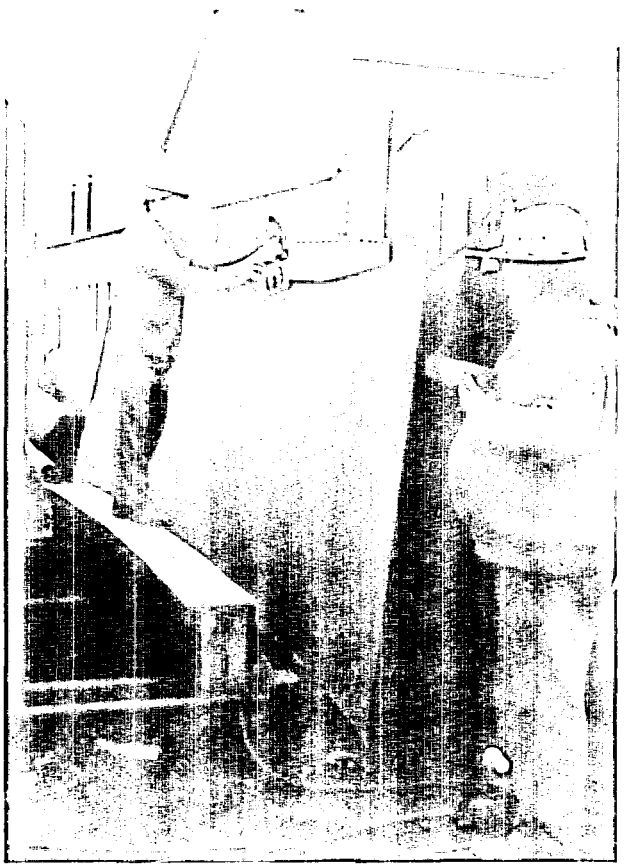

Fig. 1
A worker climbs on to the rack to position the tongs whilst at risk from an overbalancing plate.

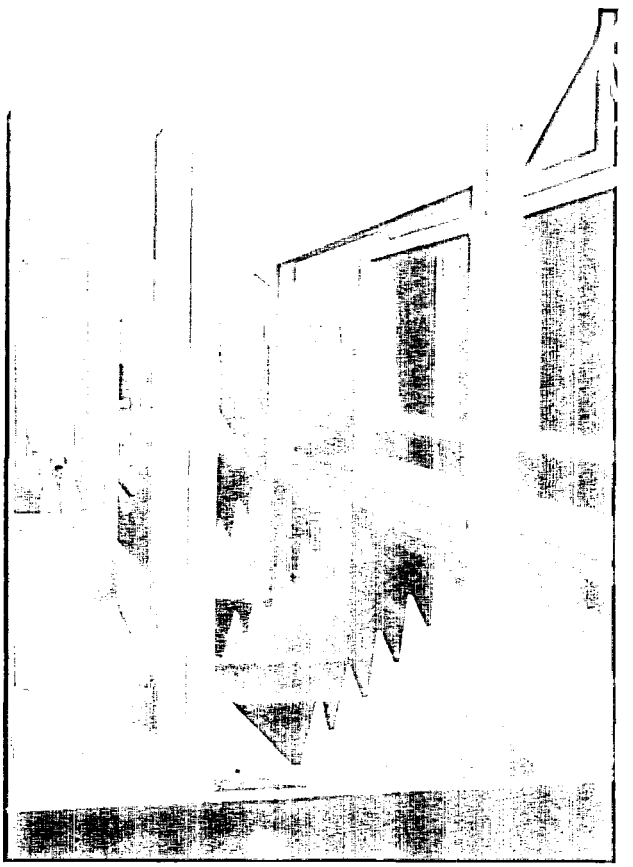

Fig. 2
The idea is to separate the storage part of the rack from the part entered by the worker in order to attach the self locking tongs, and to leave the plates positioned in such a way that they do not have to be separated.

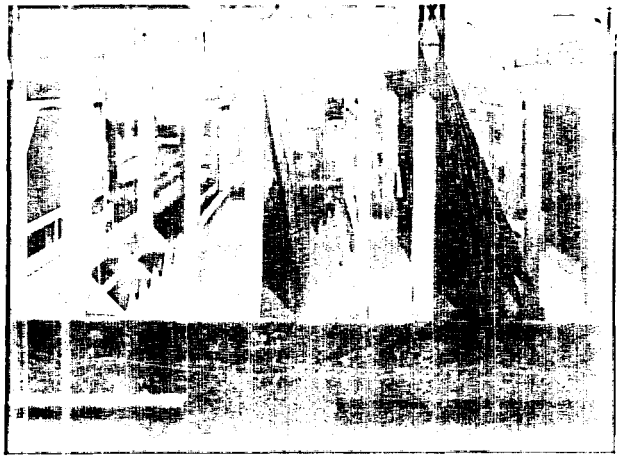

Fig. 3 (above)
Each rack is allocated a specific size of plate, and is therefore equipped with two-, three- or four- toothed plates.

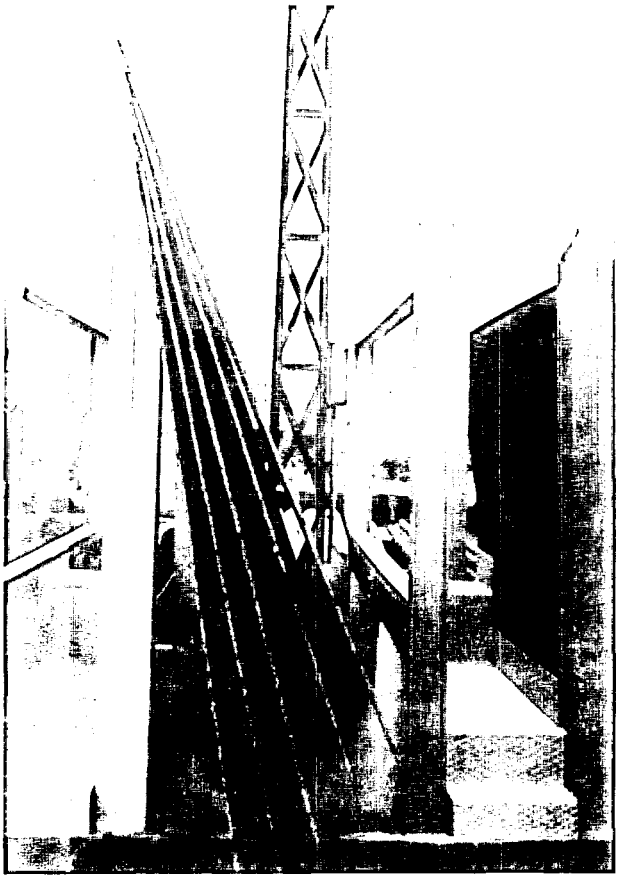

Fig. 4 (opposite)
The large plate rack; each plate is higher than the previous one so that the tongs can be attached directly.

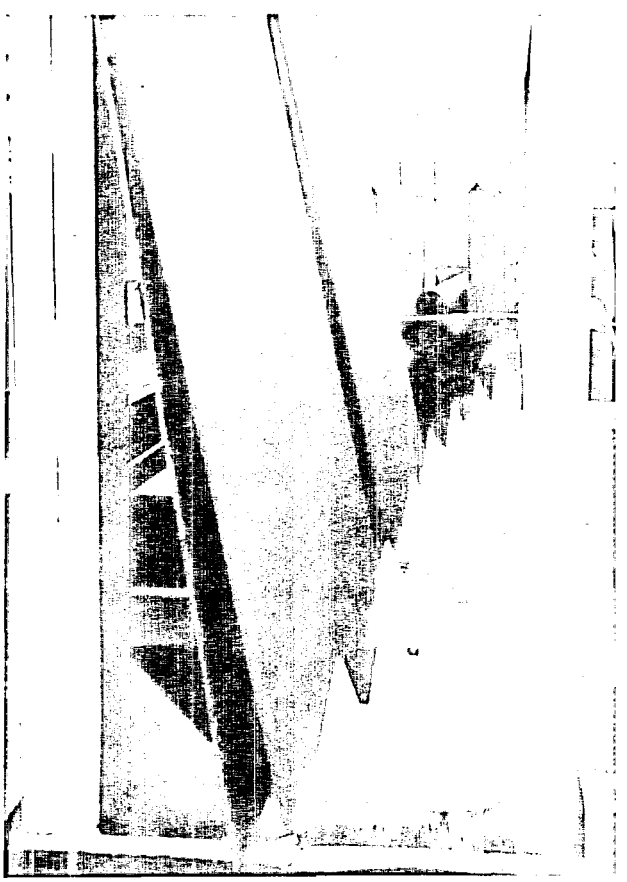

Fig. 5
The ½ plates stored for direct removal.

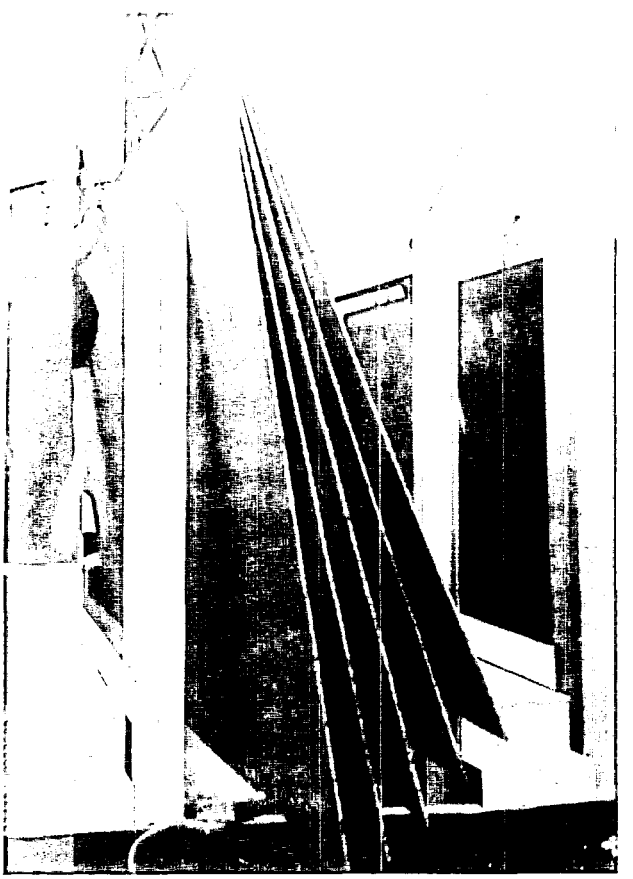

Fig. 6
Only one worker is now required to attach the tongs and he is not at risk from an overbalancing plate.

Research projects

The first allocation of financial aid available under the fifth ECSC research programme on technical control of nuisances and pollution at the place of work and in the environment of iron and steel works, adopted by the Council of the European Communities in December 1985 (OJ C 338 of 31. 12. 1985)* was made to the following research projects:

Research institute	Project No	Subject
Centro sperimentale metallurgico, Rome	7261-01/407/04	Pilot furnace study of nitrogen oxide emission from reheating furnaces and of practicable remedial measures feasible for ECSC industries
CERCHAR, Paris Bergbau Forschung LECES CRM	7261-01/408/03	Emission of nitrogen oxides in coking plants — Study of their impact on the environment
Société belge de filtration, Louvain-la-Neuve BCRA LECES	7261-01/409/02	Odour nuisance in the iron and steel and coking industries: Study of methods of prevention and control techniques
Centre de recherches métallurgiques, Liège	7261-01/410/02	Effect of the operational parameters of iron-ore sintering plants on emission of sulphur and nitrogen oxides into the atmosphere
Bergbau-Forschung, Essen CRM	7261-01/411/01	NO_x emissions and associated ambient pollution in connection with the heating of coke ovens
Institut de recherches hydrologiques, Nancy CRM CEBEDEAU	7261-02/412/03	Chemical treatment for the specific destruction of cyanides
Centre belge d'études et de documentation de l'eau, Liège IRH CRM	7261-01/413/02	Chemical treatment for the specific destruction of cyanides

* Document EUR 10338 *In extenso*, the 'Fifth research programme on technical control of nuisances and pollution at the place of work and in the environment of iron and steel works', may be obtained on request from the:
Commission of the European Communities, Directorate-General XIII-A-2, Room B 4/82, or
Directorate-General V-E-2, Room C 4/89,
Jean Monnet Building, BP 1907 L-2920 Luxembourg-Kirchberg

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