

SECTION 3, CHAPTER 1

SAFETY PRECAUTIONS

List of Contents

	<i>Para.</i>		<i>Para.</i>
Introduction	1	Electricity	26
Floor	3	Treatment for Electric Shock	27
Dress	4	Holger-Nielson Methods of Artificial	
Health and Hygiene	5	Respiration	29
Fire	6	Back Pressure Arm-lift Method	33
Machines	11	Hip-lift Back Pressure Method	41
Milling	23	Emergency Resuscitation	45
Grinding	24	Mouth-to-Mouth Method	49
Turning	25	Mouth-to-Nose Method	52

List of Illustrations

	<i>Fig.</i>		<i>Fig.</i>
Special Risk Sign	1	Ready for Inspiration	7
Will This Be You!	2	Head Position	8
It's Not Funny	3	Prepare for Inflation	9
Correct Positions	4	Inflation	10
First Movement	5	Improving Air Passage	11
Expiration	6	Mouth-to-Nose Method	12

Introduction

1. It is very important that every person employed in a machine shop has an up-to-date knowledge of all **safety precautions**. The danger of accidents is so real that, in outside industry, the Government, through the medium of the Factory Acts enforced by Factory Inspectors, exerts all possible means to keep such accidents to a minimum. Obviously the safety of service personnel is just as important as the safety of civilians; therefore, the safety precautions applicable to personnel employed in machine shops will be much the same as those applied to their civilian counterparts. Nevertheless, far too many accidents involving life and limb, and in some cases damage to expensive machinery, still occur. These are often referred to as "**bad luck**"; but **accidents do not just happen, they are caused**; and the majority are the victim's own fault. Make sure then that you are fully conversant with all safety precautions because, basically, safety depends on the individual.

**BE SAFETY CONSCIOUS:
NOT ACCIDENT PRONE**

2. A list of general safety precautions is displayed on the shop notice board and attention should be drawn to any special risks by means of suitable notices placed near the danger points (Fig. 1). Although some precautions may appear to be elementary, it should always be borne in mind that many accidents are the result of over-confidence. It is a human failing that familiarity tends to encourage the taking of risks; a machine shop is no place for carelessness.

**TAKE CARE:
NOT CHANCES**

**GOGGLES MUST
ALWAYS BE WORN
WHEN USING THIS
MACHINE.**

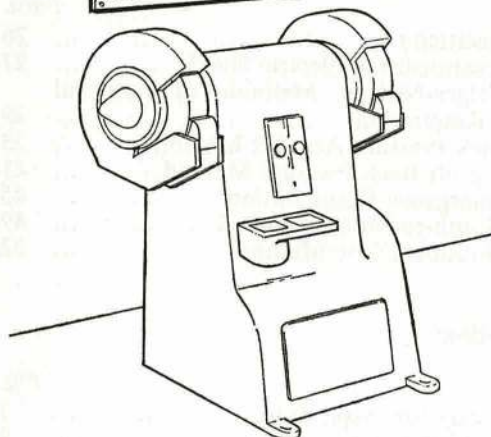


Fig. 1. SPECIAL RISK SIGN

Floor

3. The floor of a machine shop should be kept free from oil, grease or any objects, such as pieces of round section metal, which could cause a person to lose his balance and injure himself either by the fall or by contact with machinery (Fig. 2).

**A CLEANER PLACE
IS A SAFER PLACE**

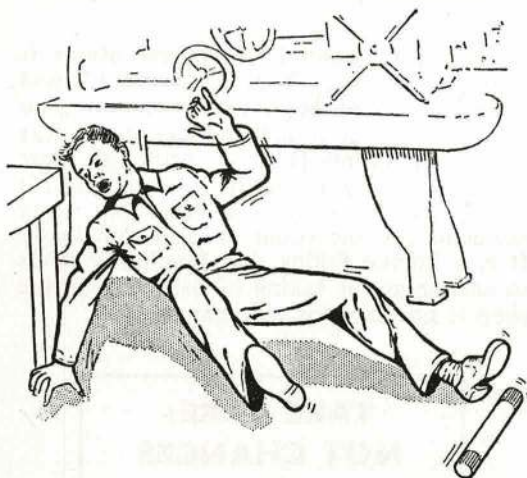


Fig. 2. WILL THIS BE YOU!

Dress

4. The clothing worn by personnel working in the machine shop should be close fitting, particularly at such positions as the sleeves. Torn overalls or dust coats, loosely tied scarves or articles of clothing that are liable to be caught in a machine or shafting must not be worn (Fig. 3). Overalls are to be worn at all times fully buttoned up.

**IT'S SAFER TO BE NEAT
FROM HEAD TO FEET**

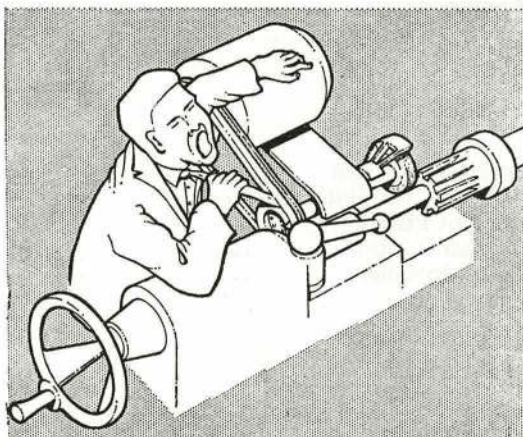


Fig. 3. IT'S NOT FUNNY

Health and Hygiene

5. The nature of the work is such that oil, grease and foreign matter is present. Therefore, it is essential that barrier cream is applied to the hands before work is commenced; to neglect this is to encourage dermatitis or other inflammation of the skin. After completion of work, and certainly before anything is eaten, always scrub and wash the hands thoroughly with soap and hot water.

**PROTECT YOUR HANDS:
DERMATITIS
CAN RENDER THEM
USELESS**

Fire

6. Many lives are lost, serious injuries are sustained, and property to the value of millions of pounds is damaged or destroyed by fire every year. Most fires could have been avoided, many having been caused by gross carelessness. It is of the utmost importance that very strict attention is given to the prevention of fire; much can be accomplished by the elimination of all factors liable to cause an outbreak of fire and by the complete observance of the regulations and orders. Adequate information is provided in A.P. 957 and Fire Orders, carefully compiled to include local requirements, are part of the standing orders of every R.A.F. station; all personnel are to be acquainted with them.

**FIRE IS YOUR ENEMY:
PREVENT IT**

7. Receptacles containing waste such as oily rags are prolific sources of fire, therefore, only metal containers should be used; such waste material should be kept separate from other rubbish. Because of the possibility of spontaneous combustion caused by the tight packing of oily waste in containers, all waste oil and combustible rubbish should be removed from the shop on cessation of work for the day, when it should be burned in a safe place or otherwise carefully disposed of.

**MAKE TIME TO DISPOSE
OF THAT RUBBISH**

8. One day it may be up to you to give the alarm; do make sure that you know where the nearest fire alarm is situated, and also the location of fire extinguishers. **SODA ACID** extinguishers are used for fires in solid materials, e.g. wood, paper, etc.; **FOAM** extinguishers are for use on burning liquids—they will smother the fire and not spread it as water would; **CARBON TETRACHLORIDE** and **METHYL BROMIDE** extinguishers are used for electrical fires.

**KNOW YOUR
EXTINGUISHERS**

9. Methyl bromide forms a toxic gas when in contact with fire or hot material; both the liquid and the gas will burn or blister the skin. If the liquid is splashed on to the skin, the affected part must be washed immediately with soap and water. Personnel affected by the vapour must not smoke; they must also obtain medical attention. These effects and precautions also apply to carbon tetrachloride.

**BE CAREFUL:
ALL THE TIME**

10. **Magnesium Alloys.** The working of magnesium alloys, electron, etc., requires special care in order to reduce the risk of fire because under certain conditions these materials are readily combustible. When machining these metals fine cuts should be avoided; the tool used should be sharp and have generous clearance, low cutting speeds being employed. Special wheels, clearly marked for identification, should be kept for grinding these metals and a rubber apron should be used to prevent particles accumulating on the clothing of the operator. Prior to "dressing", the wheels should be free from metal dust. Glasspaper should be used in preference to emery cloth during hand finishing processes. Water must not be used on a fire involving magnesium alloys because such action generates hydrogen gas which would accelerate the burning.

**EASILY IGNITED:
BUT NOT SO EASILY
EXTINGUISHED**

Machines

11. Power-driven machines can be, to the unwary, a continual source of accidents, however well the moving parts may be protected. Such accidents are usually caused by over-confidence, which must be recognized and guarded against. The danger points of machinery installed in a machine shop are fitted with guards, fencing or screening, to comply with the regulations laid down in A.P. 1464B, Vol. 1, Part 2, Sect. 3, Chap. 2.

(A.L. 18, May 64)

There are also many general precautions, such as the following, with which personnel must be familiar.

**BE CONFIDENT:
NOT
OVER-CONFIDENT**

12. Machinery must **NEVER** be set in motion without authority and without first ascertaining that neither damage nor injury will be caused.

**STOPPING TO CHECK
MAY SAVE A NECK**

13. Make sure that you know the correct way to stop a machine quickly. A "safety-minded" operator will practise this until it can be performed without the slightest delay; where a power-driven machine is involved, a quick reaction and stopping of the machine may save a lot of pain or maybe a limb.

**ALWAYS PREPARED—
TO STOP**

14. Power must be "OFF" before attempting any cleaning, lubrication or adjustment of machinery. Disregard of this regulation may save time but such time saved will never make up for a spell in hospital, or worse.

**IT'S SAFE — WHEN
THE POWER IS OFF**

15. In order to do such work as that mentioned in para. 14, it may be necessary to remove guards, fencing or safety devices. Such removal, for any reason whatsoever, will necessitate the power being "OFF", and care must be taken to ensure correct replacement before restarting operation of the machine.

**CHECK:
ARE ALL GUARDS
IN PLACE**

16. A machine must not be operated by any person who does not possess a thorough knowledge of its method of operation, safety devices and points of danger.

**LEAVE WELL ALONE
UNTIL YOU ARE
CAPABLE AND
AUTHORIZED**

17. The attention of the operator of a machine must never be diverted from his work by conversation or by any other means. One moment's inattention may cause an accident.

**WAIT—UNTIL
IT'S SAFE**

18. Anticipate rough and jagged edges on all materials before handling. **ALWAYS** use a **BRUSH** to clean swarf, chips, and other debris from the machine table, **NOT** your hand. After a cut has been taken on rotating work, whether between centres or held in the chuck, the surface is often rough enough to pick up rag or waste held to it; it could take your hand with it.

**BE CAREFUL NOW:
NOT SORRY LATER**

19. Ensure that machine tools being used are correctly "set up", i.e., not projecting too far out from the tool holder and firmly secured. Many machine operations require the work to be clamped to the table of the machine; if this clamping is not secure then anything may happen when the force of the cut is felt. This security of the work applies particularly when drilling. It is bad practice

to support the work only lightly, or even to hold it by hand when drilling a hole; someone could be hurt if the work starts to rotate.

**BETTER BE SAFE
THAN SORRY**

20. When in doubt regarding the efficiency of a machine, or the condition of any part of the machine or equipment, stop the machine and report the matter either to the instructor or to the person in charge of the machine shop as appropriate.

**WHEN IN DOUBT:
SPEAK OUT**

21. Under no circumstances are:—

- (a) Moving belts to be touched by hand.
- (b) Machines to be left unattended whilst in motion.
- (c) Machines to be used as leaning posts or rests.

**BE CAREFUL —
ALL THE TIME**

22. Make sure that you know where the first-aid box is situated and, in the event of injury, no matter how slight, report for treatment.

**FAMOUS LAST WORDS:
"IT'S NOTHING MUCH"**

Milling

23. Milling machine cutters are dangerous, therefore:—

- (a) Make sure that the guards are in position.
- (b) Stop the machine when measuring the work.
- (c) Exercise extreme care when brushing the swarf, which resembles needles, off the machine table.

(d) Ensure that the floor space around the machine is clean and dry.

**YOUR ABILITY IS
AT FIRST PRESUMED:
ONLY YOU CAN
PROVE IT**

Grinding

24. When operating a grinding machine:—

- (a) Always wear the goggles supplied.
- (b) Do not use the side of the wheel except in approved circumstances.
- (c) The tool rest must be set as near as possible to the wheel.
- (d) If the wheel has become worn and out of true, do not use it until it has been rectified by means of an emery-wheel dresser. The resulting abrasive should be brushed carefully off the machine when the operation is completed.
- (e) Use the whole face of the wheel when grinding.

**NEVER TAKE A CHANCE
WITH YOUR EYESIGHT**

Turning

25. Some particular points to remember when working on a lathe are:—

- (a) Never leave a chuck key in the chuck.
- (b) Never leave cutting tools in the tool post after use.
- (c) Do not reach or lean across the machine whilst it is in motion.
- (d) Lathe face plates, driving plates, chucks, etc., must be mounted or removed with the mandrel at rest. These fittings must not be braked by hand in order to bring the mandrel to rest after switching off the machine.

**NEVER TAKE LIBERTIES
WITH POWER**

Electricity

26. Never interfere with electric switches or fuses; "curiosity killed the cat", and electricity can certainly be lethal.

ELECTRICITY STRIKES WITHOUT WARNING

Treatment for Electric Shock

27. The first thing to be done is to free the victim from electrical contact; this can be done by switching off the power and moving the victim. If it is not possible to switch off, the victim will have to be moved with the aid of non-conductors; wear rubber gloves to pull the victim clear, or use a baulk of dry wood to push him clear.

28. Once the victim is clear of all contact, loosen all tight clothing and make sure that his breathing passages are clear; pull his tongue forward if it has gone back and, with the victim laying face downwards, apply the appropriate Holger-Nielson method of artificial respiration (paras. 29-44). Do not stop applying the respiration and do not assume that death has taken place except on the Medical Officer's authority.

Holger-Nielson Methods of Artificial Respiration

29. An accident can happen at any time and, as a result, the victim may need artificial respiration to restart breathing. It is the duty of all personnel to learn the various methods of artificial respiration; properly learned and performed, artificial respiration can save a life which would otherwise be lost through suffocation, drowning, electric shock or poisoning by gases or drugs. On such an occasion artificial respiration is required **AT ONCE—EVERY SECOND COUNTS**. It is wrong to wait for a doctor or other expert.

30. If the brain is deprived of oxygen for four minutes irreversible changes take place in it, and the aim of artificial respiration is the immediate oxygenation of the blood in order to forestall such changes. Therefore, the importance of beginning artificial respiration at once and continuing it without interruption cannot be over-emphasized. All other procedures and considerations, such as draining in the case of drowning or the administration of oxygen and drugs, must be considered secondary to artificial respiration, and be implemented only if they in no way interfere with the immediate, efficient and unrelenting application of artificial respiration.

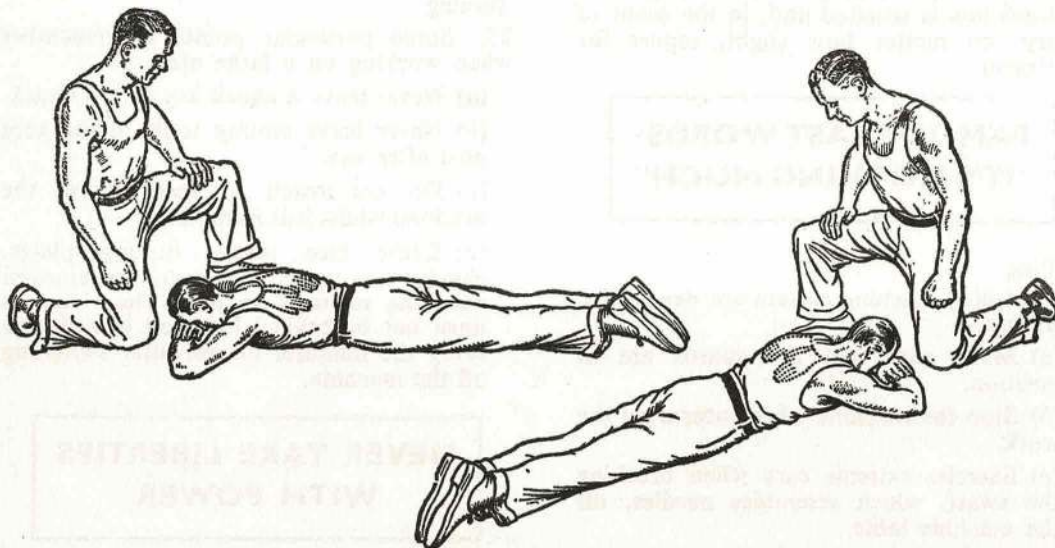


Fig. 4. CORRECT POSITIONS

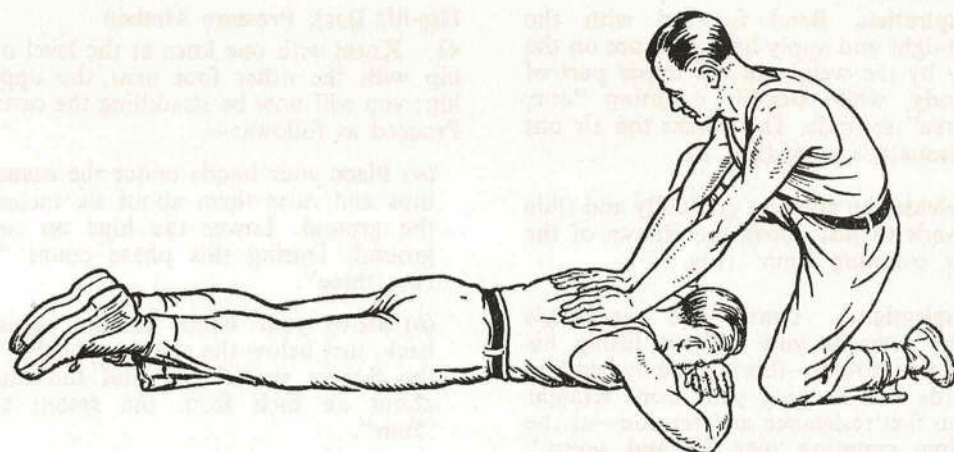


Fig. 5. FIRST MOVEMENT

31. Artificial respiration is not to be used where asphyxia has been caused by corrosive gases or poisons.

32. There are two methods of applying Holger-Nielson artificial respiration:—

(a) **The Back Pressure Arm-lift Method.** This method is used whenever possible.

(b) **The Hip-lift Back Pressure Method.** Used when method (a) is not possible, for example, when the victim's arms or shoulders are injured.

Back Pressure Arm-lift Method

33. Lay the casualty face downwards, raise his arms above his head and flex his elbows so that one hand rests on the other wrist. Rest the forehead on the uppermost wrist, kneel on one knee at the casualty's head,

with the inner side of the knee in line with his cheek and about six inches away from it. Immediately the correct positions have been obtained (Fig. 4), commence artificial respiration.

Note.—If there is a second person available, he should be told to loosen any tight clothing and ensure that the casualty's nose and mouth are clear of obstructions; this must be done without interrupting artificial respiration, and the person should then be sent to get a doctor.

34. The first movement is to place both hands on the casualty's shoulder blades, with the thumbs touching the spine and the fingers pointing to the casualty's feet (Fig. 5); then proceed as in paragraphs 35 to 44.

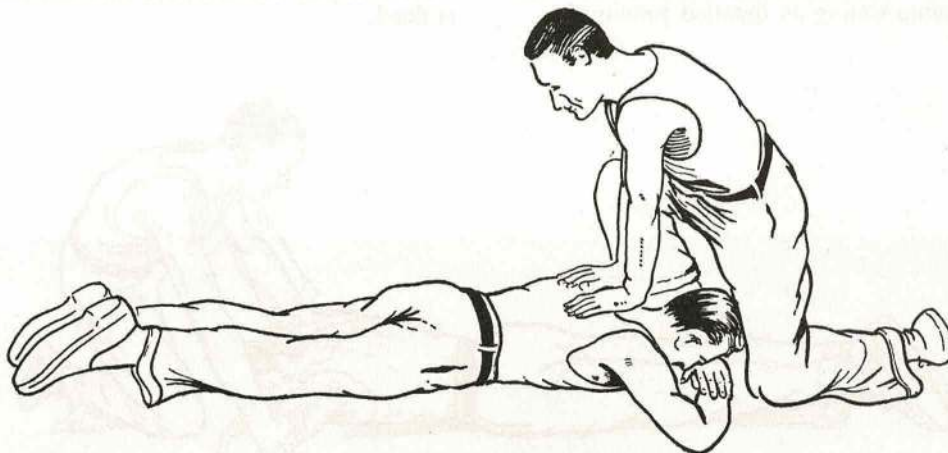


Fig. 6. EXPIRATION

35. **Expiration.** Bend forward with the arms straight and apply light pressure on the casualty by the weight of the upper part of your body, while steadily counting "one, two, three" seconds. This forces the air out of the casualty's lungs (Fig. 6).

36. Release the pressure gradually and slide your hands to just above the elbows of the casualty, counting "four" (Fig. 7).

37. **Inspiration.** Draw the casualty's shoulders towards you without lifting his chest off the ground—this is done by bending backwards and keeping your arms straight until you feel resistance and tension—at the same time counting "five, six and seven". This draws air into the casualty's lungs.

38. Lay the casualty's arms down and replace your hands on the shoulder blades, counting "eight".

39. Repeat the movements to the same timing by "one, two, three", in the same order as in the preceding paragraphs.

40. When the casualty restarts breathing the need for applying pressure on the back has passed, but continue with the arm raising and lowering at the following rate:—"one, two, three", arm raising—"four, five, six", arm lowering.

Note.—If there are chest injuries, do the arm raising and lowering only. If the arms and chest are both injured, do arm raising and lowering but grasp the arms under the armpits. Use the same timing as detailed previously.

Hip-lift Back Pressure Method

41. Kneel with one knee at the level of the hip with the other foot near the opposite hip; you will now be straddling the casualty. Proceed as follows:—

(a) Place your hands under the casualty's hips and raise them about six inches off the ground. Lower the hips on to the ground. During this phase count "one, two, three".

(b) Move your hands to the casualty's back, just below the shoulder blades, with the fingers spread out and the thumbs about an inch from the spine; count "four".

(c) Rock forward, keeping your arms straight, and apply steady pressure downwards, counting "five, six, seven".

(d) Rock backwards, release the back pressure, then grasp the hips as detailed at (a), meanwhile counting "eight".

42. Repeat this cycle as long as necessary.

43. **Women and Children.** Use the methods as detailed, taking care not to exert too much pressure; use only the fingertips when treating children.

44. Continue artificial respiration as long as necessary. In some instances life has been restored after an hour or more of unceasing work; therefore, hope should not be given up until a doctor has certified that the casualty is dead.

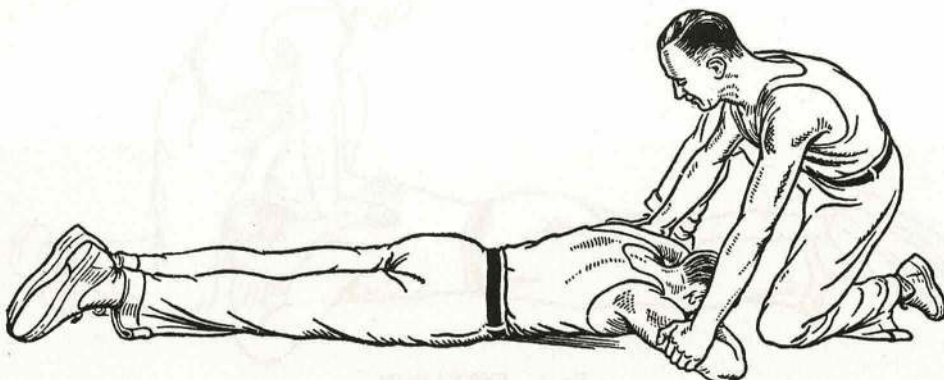


Fig. 7. READY FOR INSPIRATION

Summary

- (a) Remove the casualty to the open air.
- (b) Position the body as detailed in para. 33.
- (c) Commence artificial respiration immediately. Do not lose a second.
- (d) Send for a doctor if there is a second person available.
- (e) Do not let anything interfere with the steady rhythm of artificial respiration.

Emergency Resuscitation

45. In the normal healthy body oxygen is taken in and is fed to the brain by way of the blood stream. Irreversible changes take place if the brain is deprived of oxygen, in fact the person will die if the delay is too long. The brain can be deprived of oxygen in a number of ways, for example unconsciousness because of electric shock, drowning, and so on. Thus, the immediate aim of resuscitation must be to provide the casualty with oxygen in order to forestall such changes, and this can be done by blowing into the casualty's mouth or nose in the manner described in the following paragraphs.

46. This method of artificial respiration is preferred to all other methods because:—

- (a) The casualty's body does not have to be worked upon or moved, therefore if there is other damage, such as broken bones etc., the damage will not be aggravated or extended.

(b) It provides the greatest ventilation of the lungs enabling the casualty to obtain a greater amount of oxygen.

(c) It is easy to apply; even a child can apply this method.

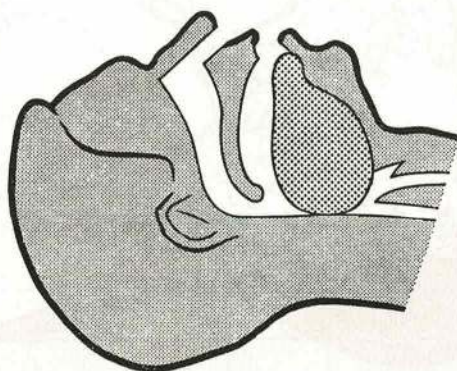
(d) It is less tiring and does not require strength.

47. The normal method is by mouth-to-mouth, but if the casualty is in a state of spasm or convulsion, or perhaps the person is without teeth, then resuscitation will be by mouth-to-nose.

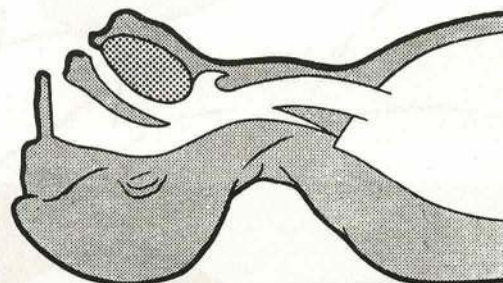
48. In the unconscious casualty lying on his back, the tongue may fall backwards and block the air passages, but if the neck is extended, the head pressed backwards and the lower jaw pushed upwards, the tongue moves forward and uncovers the air passages (Fig. 8).

Mouth-to-Mouth Method

49. With the casualty lying on his back, hold the head in both hands, one hand pressing the head backwards and the other pushing the lower jaw upward and forward (Fig. 9). Open your mouth wide, take a deep breath, seal your lips around the casualty's mouth, while obstructing his nostrils with your cheek or pinching them together with your fingers, and blow into his lungs.



AIR PASSAGE IS BLOCKED



AIR PASSAGE IS CLEARED

Fig. 8. HEAD POSITION

(A.L. 18, May 64)

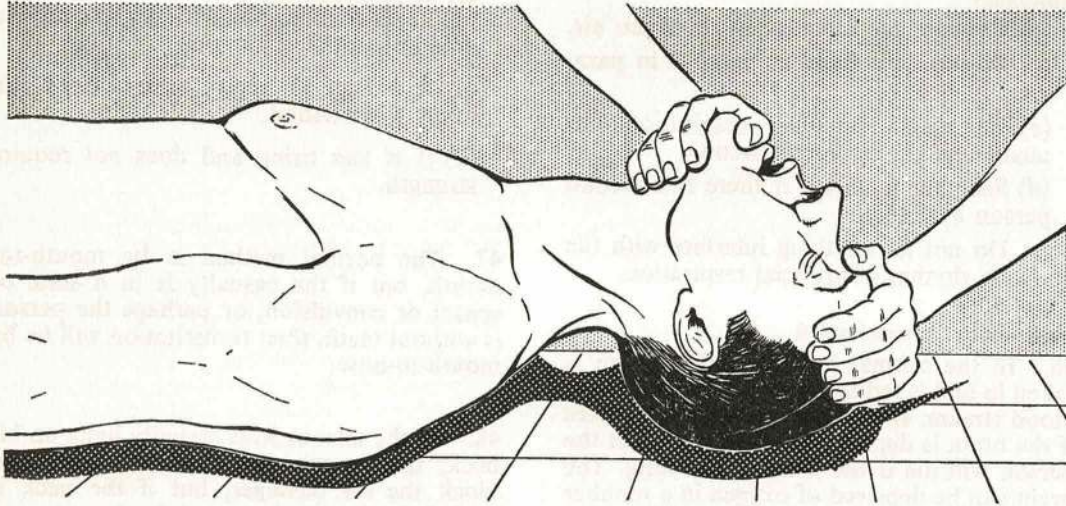


Fig. 9. PREPARE FOR INFLATION

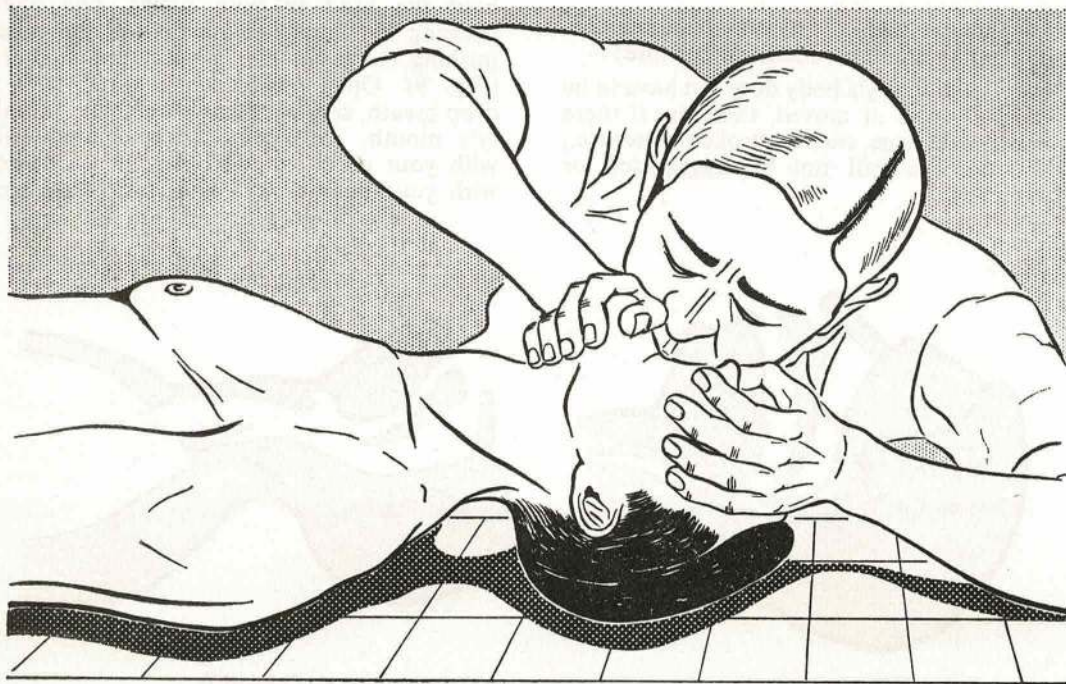


Fig. 10. INFLATION

Watch for the casualty's chest to rise, then remove your mouth. The first six inflations should be given as quickly as possible, and the inflation rate should be ten in every minute (Fig. 10).

50. The urgency of inflating the casualty's lungs, even though the air has to be blown past an obstruction in the throat or windpipe, cannot be overstressed. Delay of even one or two seconds may prove fatal. Therefore, if there is any doubt about the air passages, take the immediate action of inflating the lungs whilst simultaneously positioning the head and lower jaw to open the air passage. This is done by gripping the back of the head between the hands with the fingers gripping the angles of the jaw and, while extending the head backwards, pushing the jaw forward and upward (Fig. 11).

51. Not infrequently it will be found that as soon as the air passage is clear and the lungs inflated, the casualty will gasp and start to breathe spontaneously. Gurgling or noisy breathing indicates that the throat needs to be cleared of fluid or debris.

Mouth-to-Nose Method

52. As stated previously, this method of resuscitation must be used when the casualty

is in a state of spasm or convulsion, or has no teeth.

53. Again work from the side of the casualty, making sure that his head is extended. Open your mouth wide, take a deep breath and seal your mouth round the casualty's nose, making sure that your lips are not obstructing his nostrils. Close the casualty's mouth by placing your thumb on the lower lip, and inflate his lungs (Fig. 12).

54. If the casualty's head is not sufficiently extended the soft palate will allow inflation through the nose but may prevent expiration. When this happens, part the casualty's lips with your thumb after each inflation.

55. If efforts to inflate the casualty's lungs by any of the methods detailed are not successful, then make sure that there is no obstruction in the mouth or throat. If an obstruction is found, remove it; this may entail turning the head to one side. If the obstruction is thought to be in the casualty's windpipe, turn the body on its side, strike three or four sharp blows between the shoulders and, by feeling with your fingers, check if any debris has come into the throat; remove any such debris and start inflation again.

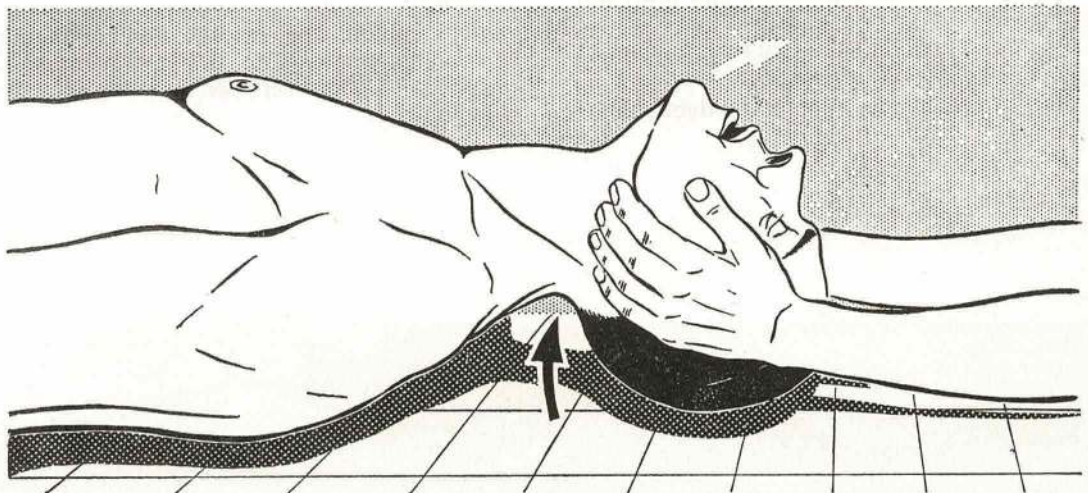


Fig. 11. IMPROVING AIR PASSAGE

(A.L. 18, May 64)

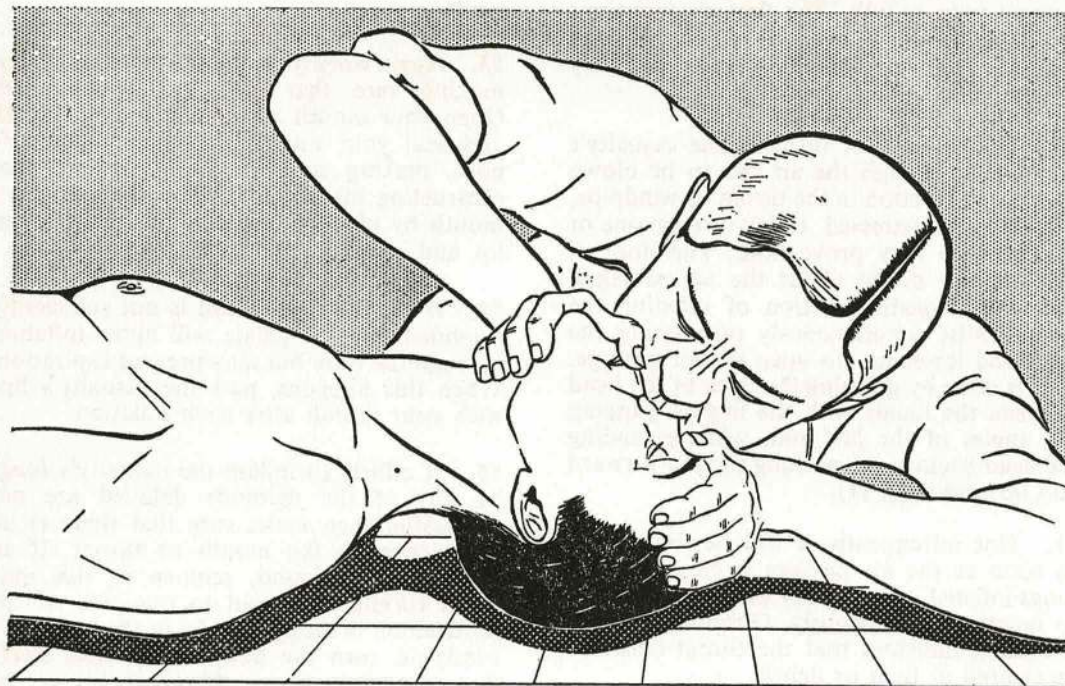


Fig. 12. MOUTH-TO-NOSE METHOD

Summary

- (a) Commence resuscitation immediately. Time is of vital importance and must not be wasted.
- (b) Send for medical assistance as soon as a second person is available.
- (c) Clear any obstruction of debris from

the casualty's mouth or windpipe in the manner detailed and restart inflation of the lungs.

- (d) Continue the resuscitation until the casualty responds to the treatment or a Medical Officer certifies that the casualty is dead.



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