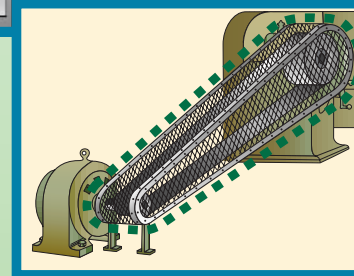
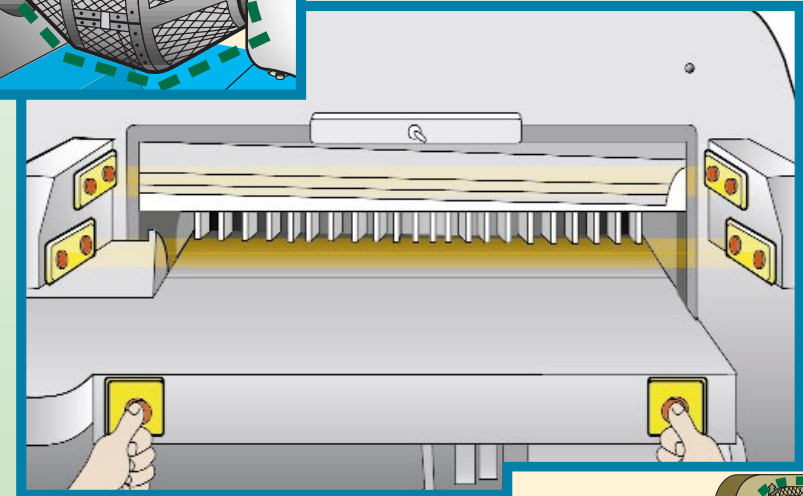
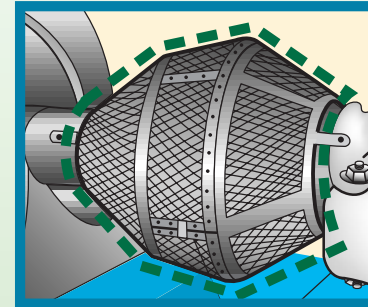


# 機械的防護及操作手冊

## HANDBOOK ON GUARDING AND OPERATION OF MACHINERY



勞工處職業安全及健康部  
Occupational Safety and Health Branch  
Labour Department

1/2003-3-B30



勞工處職業安全及健康部  
Occupational Safety and Health  
Branch Labour Department

本手冊由勞工處  
職業安全及健康部印製

This handbook is prepared by the  
Occupational Safety and Health Branch  
Labour Department

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2003年1月 本版

*This edition January 2003*

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本手冊歡迎複印，但作廣告、批核或商業用途除外。如需複印，請註明錄自勞工處《機械的防護及操作手冊》

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# 機械的防護及操作手冊

## **HANDBOOK ON GUARDING AND OPERATION OF MACHINERY**

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# 1. 引言

《工廠及工業經營(機械的防護及操作)規例》指定應呈報工場的東主，必須在每部利用機械推動的機械及工業裝置的危險部件加以有效防護。本手冊向東主及機械與工業裝置的製造商提供所需資料，使能依照此規例所訂的標準裝置護罩。如在設計機械時，一併包括妥善的護罩在內，會比較廉宜；且機械一經製成及使用後再進行改裝，技術上可能會有困難，或甚至於不可能，此點實需注意。東主在向機械製造商或供應商訂購新機械時，最好能指定護罩的規格。如能在此階段稍為費神及多花少許費用，日後在加裝護罩方面即可省回大量金錢及不少麻煩。

機械的各危險部件已列於該規例的附表1內。雖然此等危險部件有數類是與原動機或傳動機械有關，但根據機械所造成的意外數字統計，不是很多意外事件涉及原動機或傳動機械。此外，在機械開動時，工人無須接觸原動機或傳動機械，而此等機件亦很少需要調整。但另一方面，工人難免要經常接觸機械的操作點。故此，裝在操作點的護罩的設計、構造、安裝及保養等事宜，實應特別留意。機械所造成的意外受傷，多屬嚴重性的，並可能導致傷者的手指、手掌或臂部截斷，以致傷者蒙受永久性殘廢。然而，沒有護罩或防護不足的機械，即使經長期操作仍未遭遇到任何意外事件，亦不足以證明其移動部件並不危險。若倚賴操作員所受的訓練、技巧或小心操作來代替完善的護罩，實屬危險之舉。因為人的性情難以推測，而且並非固定不變。即使最可靠、謹慎的操作員，亦會有出錯，尤其是從事彼所熟習的工作為然。此外，安全措施對謹慎的操作員固然重要，對粗心大意的操作員更是必需的。妥善的護罩不論何時均可確保操作安全，給予操作員信心。妥為設計、安裝及保養的護罩可使機器的產量增加。所以，安裝完善的護罩以消除機器的危險性，對工業實有莫大裨益。

# 1. Introduction

The Factories and Industrial Undertakings (Guarding and Operation of Machinery) Regulations state that proprietors of notifiable workplaces must effectively guard dangerous parts of every piece of machinery and plant which is driven by mechanical power. This handbook acquaints them and makers of such machinery and plant with necessary knowledge to provide guarding of the standard required by these regulations. It is important to appreciate that effective guarding incorporated at the design stage of a machine is cheaper. Modification after a machine has been introduced may be technically difficult or even impracticable. Proprietors are strongly advised to consider stating the specifications on guarding standard when they place orders for new machinery with their machine makers or suppliers. A little more trouble and outlay at this stage may well save them a great deal of later expense and trouble.

Dangerous parts of machinery are specified in the First Schedule of the regulations. Although several of these parts relate to prime movers or transmission machinery, statistics on machinery accidents indicate clearly that not many of these accidents involve prime movers or transmission machinery. Moreover, access to prime movers or transmission machinery is unnecessary and adjustments are rarely needed when the machine is in operation. On the other hand, access to points of operation of a machine is frequent and often inevitable. Particular attention should therefore be paid to the design, construction, installation and maintenance of guards provided for points of operation. Injuries resulting from machinery accidents are often serious and lead to amputation of fingers, a hand or an arm and to permanent disability for the injured. Nevertheless, absence of injury from operating an unguarded or inadequately guarded machine for a length of time is by no means a proof that its moving parts are not dangerous. A mere reliance on the operative's training, skill or constant attention in substitution for effective guarding is dangerous because human nature is unpredictable and not constant. Even the most reliable and careful operative can make mistakes, especially in familiar work. Besides, it is essential to afford safeguards not only for the careful but also for the careless. Proper guarding can ensure safe operation at all times and gives confidence to operatives. Guards which are properly designed, installed and maintained can help to increase the production capacity of the machine. Therefore, elimination of mechanical hazards by providing effective guarding is a positive gain to industry.

## 2. 機械的防護及操作

### 一般原理

2.1 《工廠及工業經營(機械的防護及操作)規例》規定，凡機械或工業裝置的危險部件須加以防護。有效防護的方法須以下述任何一種方法或其任何組合達成：

- (甲) 固定式護罩
- (乙) 互鎖式護罩
- (丙) 自動式護罩
- (丁) 觸覺式護罩
- (戊) 雙手控制裝置

### 固定式護罩

2.2 固定式護罩在設計與構造上可防止工人接觸到機械的危險部件。此種護罩並無移動部件與裝上該護罩的機械相聯或受該機械控制。此種護罩很可靠，不大需要保養。然而，其適用範圍只局限於防護原動機、傳動機械及備有機械或特設的輸送設備，且自動放入工件及抽離製成品的機械操作點。但如需人手放入工件及抽離製成品時，固定式護罩的孔口大小應有一定限制，並須與機械的危險部件的距離成比例。下列規格必須遵守。

固定式護罩的孔口與危險部件之間的最短距離	孔口最闊處量度所得的最大寬度
40 毫米	10 毫米
65 毫米	12 毫米



## 2. Guarding and Operation of Machinery

### General Principles

2.1 The Factories and Industrial Undertakings (Guarding and Operation of Machinery) Regulations require that dangerous parts of machinery or plant must be effectively guarded by any one of the following types of methods or by a combination of them:

- (a) a fixed guard,
- (b) an interlocking guard,
- (c) an automatic guard,
- (d) a trip guard,
- (e) a two-hand control device.

### Fixed guard

2.2 A fixed guard by its design and construction prevents access to the dangerous part for which it is provided. Such a guard has no moving parts associated with or dependent upon the machine to which it is fitted. It is a reliable guard and requires little maintenance. Its application, however, is limited to guarding prime movers, transmission machinery and points of operation where feeding of material and withdrawing of components are achieved mechanically or by means of specially-designed aids. However, if manual feeding and withdrawal are necessary, the opening in the fixed guard must be limited in size relative to the distance between such an opening and the dangerous part of the machinery. The following specifications must be observed.

Minimum distance between  
the opening in the fixed  
guard and the dangerous part

40 mm

65 mm

Maximum size of the  
opening measured at the  
widest point

10 mm

12 mm

固定式護罩的孔口與危險部  
件之間的最短距離

90 毫米  
140 毫米  
165 毫米  
190 毫米  
320 毫米  
400 毫米  
450 毫米  
800 毫米

孔口最闊處量度所得的最大  
寬度

15 毫米  
20 毫米  
22 毫米  
30 毫米  
40 毫米  
50 毫米  
55 毫米  
150 毫米

## 互鎖式護罩

**2.3** 互鎖式護罩在設計上可使裝有此種護罩的機械，只有在護罩位於關閉位置時方能操作，而在機械運行時，護罩不能打開，或護罩一旦移離關閉位置，機械便會立刻停止操作。互鎖性能通常是由一組電氣互鎖以控制機械的操作及機械互鎖以控制護罩的開關。互鎖式護罩最適宜用於防護在每個操作循環都需用人手放入工件及抽離製成品的操作點，以及防護須要經常接觸的機械沉重旋轉部件。互鎖裝置在構造上及安裝的位置，以不易遭受干擾及弄壞為佳。如互鎖系統內任何配件失靈，機械便應不能開動。若干微型電掣很易因電鈕被按下而失靈。不可靠的互鎖裝置在損壞時會導致危險，而可靠的互鎖裝置則在損壞時仍能確保安全。互鎖式護罩需要高度保養及需有可靠的定期試驗及檢查制度。

Minimum distance between the opening in the fixed guard and the dangerous part	Maximum size of the opening measured at the widest point
90 mm	15 mm
140 mm	20 mm
165 mm	22 mm
190 mm	30 mm
320 mm	40 mm
400 mm	50 mm
450 mm	55 mm
800 mm	150 mm

## Interlocking guards

2.3 An interlocking guard is designed to operate in such a manner that the machine on which it is installed cannot be operated unless the interlocking guard is in a closed position; and the guard cannot be opened unless the machine is not in motion or its removal from a closed position causes the machine to cease its motion at once. The interlocking features are normally achieved by means of a combination of electrical interlock to control the operation of the machinery and mechanical interlock to control the opening of the guard. An interlocking guard is most useful for guarding points of operation where feeding of material and withdrawing of components are required in every cycle of operation and for guarding heavy rotating parts of a machine to which access is required on regular occasions. The interlocking devices should be so constructed and located that they cannot be readily tampered with or defeated. If a component of the interlocking mechanism fails, the machine should not be capable of being set in motion. Certain electrical limit switches can easily be defeated by depressing a contact button. Interlocking arrangements which are not reliable are known as 'fail to danger type' and those which are reliable are known as 'fail to safety type'. Interlocking guards require a high degree of maintenance and a reliable system of regular testing and inspection.

## 自動式護罩

2.4 自動式護罩在設計上可自動防止操作員或其手部在機械的危險部件運行時，觸及該部件。護罩的活動部件應受機械危險部件的運行所推動，其動作方式可在操作點前由一邊撥至另一邊，或從機械的一邊向外及向上推出，或一種拉手式動作，將操作員的手拉離危險區。自動式護罩適用於在操作循環中需人手放入工件的機械，例如啤機及鍛錘。此乃依靠一種機械連繫，使自動式護罩的動作受操作點運行所控制，同樣又可令其速度增加，以超越操作點的速度。自動式護罩的機件須根據危險部件的運行及其本身特徵予以調整，並應經常檢驗，以確保該安全護罩妥為保養及使用適當。若干運行快速的機械並不適宜採用此種護罩，因為護罩的速度過高，會令致護罩本身具有危險性。

## 觸覺式護罩

2.5 機械觸覺式護罩的主要部件為裝有一可轉動之柵或框架與機械裝置相連，該裝置能令離合器分開或使皮帶脫離轉動位置，同時使用剎掣令機器停止運行。該框架安裝在機械操作點的前面，故此在操作點開始運行時，如手或手臂的任何部分進入危險區，便會撞及框架，使機器停止運作。

## Automatic guards

2.4 An automatic guard is designed to automatically prevent an operator or his hands from coming into contact with the dangerous part of a machine when that part is in motion. The movable part of the guard should be positively actuated by the movement of the dangerous part of the machinery. It may take the form of a sweeping motion from side to side in front of the point of operation, or of an outward and upward push-away motion from the side of the machine, or of a pull-out action which removes an operator's hands from the point of danger. An automatic guard is suitable for use on a machine whose cycles of operation are interspaced by manual feeding of materials, e.g. power presses and drop hammers. It relies on a mechanical linkage which derives its motion from the movement of the point of operation. The movement, so transmitted, is multiplied so that the guard moves at a rate faster than the point of operation. The mechanisms of automatic guards must be carefully adjusted in relation to the movement and physical characteristics of the dangerous parts, and frequently examined to ensure that the safeguard is properly maintained and used. In certain fast acting machine, it is not advisable to adopt this type of guard because of the high speed with which the guard is inevitably involved, thus becoming a potential danger in itself.

## Trip guards

2.5 A mechanical trip guard consists essentially of a pivoted grid or frame connected to a mechanism which can stop the machine by throwing out the clutch or belt-striking gear and applying a brake. The frame is mounted in front of the point of operation of the machine so that if any part of the hand or arm is in the danger zone as the point of operation begins its motion, the frame will be struck and will stop the machine.

**2.6** 另外一種觸覺式護罩為光電安全裝置（電眼）。一條或多條光線在操作員與機械危險部件的空間處形成屏幕。此光電安全裝置經特別設計，當光線受阻撓時，繼電器便生效，隨而令一機械裝置產生作用，阻止操作點的開動或繼續運行。

**2.7** 觸覺式護罩最適宜用於一般不斷開動的機械，而間中須將手（或身體的其他部分）放入機械危險部件所經的地方，或在放入原料或工件時，會被纏繞的地點。觸覺式護罩的效能是否良好，須視乎機械的制動效能，能否在一定的範圍內令機停止。因此，效果良好的制動器，通常是必要的。機械觸覺式護罩在設計上，應使機械在護罩未重新裝妥前不能再度開動。

## 雙手控制裝置

**2.8** 雙手控制裝置在設計上，必須要操作員雙手連續操縱控制器，方能完成操作循環，而假如操作員單手或雙手停止操縱控制器，機械會立即停止運作。雙手控制系統可分為氣動、油壓推動、電動或機械推動。為預防某些操作員自作聰明，在雙手控制裝置內安裝定時器是十分重要的。此種裝置可使操作循環在各控制器同時被按下時才能發動。作此用途的定時器在市面上很易獲得，其時間差額不超過若干毫秒。

2.6 Another form of a trip guard is the photoelectric safety device (electric eye) - it is a light beam or beams, arranged as a curtain across the space between the operator and the dangerous part of machinery. The photoelectric safety device is so arranged that the interruption of the beam will activate an electrical relay which in turn sets a mechanism into action to prevent starting or further movement of the point of operation.

2.7 Trip guards are most suitable for use on machines which are normally in continuous motion where the hands (or other parts of a person) have temporarily to enter a space swept by the dangerous part, or where entangling may occur in an article or material which is being fed to a machine. The effective performance of a trip guard is greatly dependent upon the stopping characteristics of the machine which must be controlled within defined limits. An efficient brake is normally a necessity. The design of mechanical trip guards should be such that the machinery cannot again be set in motion unless and until the guard has been reset.

## **Two-hand control devices**

2.8 A two-hand control device is so designed that the operator's hands must continuously engage the controls of the machine in order that its cycle of operation can be completed and if one or both of the operator's hands cease to engage the controls, the machine stops immediately. A two-hand control system can be pneumatic, hydraulic, electric or mechanical. For guarding against the perverse ingenuity of some operators, it is important to install a timer mechanism in a two-hand control device so that the controls must be engaged simultaneously before a cycle of operation can be set in motion. Timer mechanisms which permit no more than a few milliseconds are readily available for this purpose.

## 護罩的構造

**2.9** 護罩必須堅固，構造須妥善，而材料須不易燃燒。在可能範圍內，護罩應盡量選用堅實材料，因其比多孔或網形的結構為佳。如採用鋼片，其最低厚度應為英制線規**18**號（**1.2**毫米）。如採用網形防護方法，其網孔應小至手指不能由該處伸入機械危險部件為準。護罩的各部分應用螺栓或鉚釘旋緊。蝶形螺帽或類似的連接配件，在這方面不大適合，因此法很容易使護罩的各部分被拆離。

## 護罩的保養

**2.10** 護罩應繫緊在固定位置上，並須經常檢查，以確保其保養妥善，位置正確。甚多機械的防護裝置是採取設有可開啟的部件或活動門的封閉方式。此等部件應裝有可靠的緊鎖裝置，且應有適當措施以確保在機械開動時，能使該部件保持在關閉及鎖緊的位置。如經常要打開護罩的某部分以便工人能接近機件時，則該部分護罩應與操作的控制互鎖在一起。

**2.11** 由調查機械意外事件所得，證實所有互鎖式護罩、自動式護罩、觸覺式護罩及雙手控制裝置皆需要定期檢查及試驗。有關人士實應指派一名負責人定期檢查及試驗此等護罩，並應保存一份有關檢驗及已採取何種行動的紀錄。



## **Construction of guards**

2.9 Every guard must be rigid and of substantial construction, and the materials incombustible. Wherever practicable, guards should be made from solid material in preference to perforated or open mesh construction. If sheet steel is used, the minimum thickness should be S.W.G.18 (1.2mm). Where open mesh guarding is chosen, the apertures should be such that finger access to the dangerous parts is not possible. Wing nuts or similar fastenings should not be used to secure the various sections of guard because they are too easily removed. The sections should be bolted or riveted.

## **Maintenance of guards**

2.10 Guards should be secured in position, and regular and frequent checks should be made to ensure that they are in a good state of repair and kept in position. On many machines, guarding is by enclosure with hinged sections or access doors. Secure locking devices should be fitted to them and measures should be taken to ensure that they are kept in the closed and locked position whenever the machinery is in motion. In cases where a section of a guard has to be removed frequently to afford access, it is good practice to interlock the section of the guard with the operating mechanism.

2.11 Investigations into machinery accidents confirm the need for regular inspection and testing of all interlocking guards, automatic guards, trip guards and two-hand control devices. It is strongly recommended that inspections and testing should be carried out at regular intervals by a responsible person, and that a record should be kept of the results and any action taken.

### 3. 機械或工業裝置的危險部件

下列各頁所載的舉例及圖解，為《工廠及工業經營(機械的防護及操作)規例》所訂明的十七類機械的危險部件及其有效的防護方法。

#### 第一類：旋轉軸、聯結器(噏輪)、心軸、芯棒、 桿條及飛輪

(圖表載於第32頁至第34頁)

轉軸表面有平滑，有粗糙，轉動速度有慢有快，而直徑亦有大有小。它們在轉動時，除非加以遮蓋，否則具有危險。外表看似平滑的轉軸，能將衣服或頭髮纏繞，因而釀成嚴重意外。固定式護罩可將轉軸、聯結器(噏輪)、心軸、芯棒及桿條等有效地防護。

#### 第二類：一對旋轉部件之間的轉入夾口

(圖表載於第35頁至第37頁)

一對旋轉部件，例如轉軸或滾軋，沿相反方向轉動時，即呈現一處轉入夾口。該對旋轉部件轉動之際，因互相緊密接觸或距離極近，以致在兩輪間出現一處危險夾口。此類轉入夾口於軋鋼機、P.V.C.滾軋、橡膠、造紙及印刷業的滾筒及滾軋均可發現。

固定式護罩可將齒輪及摩擦輪加以有效防護，而多類滾筒，不論其接觸面是否緊密，亦可裝上特別設計的夾口護罩，予以有效防護。請參閱圖表。

## 3. Dangerous Parts of Machinery or Plant

The following pages contain examples and illustrations of the 17 groups of dangerous parts of machinery or plant as defined in the Factories and Industrial Undertakings (Guarding and Operation of Machinery) Regulations and effective guarding for them.

### **Group 1: Revolving shafts, couplings, spindles, mandrels, bars and flywheels**

(Figures on page 32 to page 34)

A shaft may be smooth or rough, may rotate slowly or rapidly, and may be small or large in diameter. It is dangerous when revolving unless it is covered. Shafting which appears to be smooth can grip clothing or hair and cause serious accident.

Shafts, couplings, spindles, mandrels and bars can be effectively guarded by fixed enclosure guards.

### **Group 2: In-running nips between pairs of rotating parts**

(Figures on page 35 to page 37)

An in-running nip exists when a pair of rotating parts such as shafts or rolls rotate in opposite direction. The pair of rotating parts may rotate in close contact or very near to one another so that there exists a trapping danger between the two rotating parts. In-running nip points of this nature are found on steel rolling mills, p.v.c. rolls, calenders and rolls in the rubber, paper and printing industries.

Gear wheels and friction wheels can be effectively guarded by fixed enclosure guards while many close contact rolls or non-contact rolls can be guarded by specially designed nip guards. Please see figures.

### 第三類：傳動帶滑輪組的轉入夾口

(圖表載於第38頁至第40頁)

在傳動帶與滑輪之間、鏈輪與鏈之間等處的接觸點，即有夾口。轉入夾口的危險性，舉例而言，可將操作員的手部或手指拖曳入機內予以壓碎。手掌或手指一旦被捲入，欲要抽回亦絕不容易。

以金屬片或鐵網製成的固定式護罩可將轉動帶滑輪組的轉入夾口，加以有效防護。請參閱圖表。

### 第四類：轉動部件的突出部分

(圖表載於第41頁)

此類的典型例子為旋轉軸或桿條上的聯結螺栓及定位螺絲。其潛伏的危險程度：尤大於第一類所列的旋轉軸、桿條等。有效的防護方法為安裝固定式護罩，至於定位螺絲，則可將之埋入轉軸或桿條的鑽孔內。

### 第五類：斷續旋轉部件

(圖表載於第42頁至第43頁)

呈現空隙的旋轉部件，例如幅輪、風扇葉、幅枝飛輪等均具有危險性。此等部件能將手掌或手臂捲入機內，加以扭折或扯裂，同時又能將衣物纏繞。此等部件當僅接觸到皮膚表面時，即可將手臂或手掌捲入危險區而造成嚴重傷害。以金屬片或粗鐵網製成的固定式護罩可予以有效防護。

## **Group 3: In-running nips of the belt and pulley type**

(Figures on page 38 to page 40)

Nip points are found on the points of contact between belts and pulleys, between chains and sprocket wheels etc. The danger of in-running nips is that they can, for example, draw in an operator's hand or fingers and crush them. Once the hand or finger is drawn in, it is difficult to withdraw it.

Fixed guards, either of sheet metal or wire mesh, can effectively guard the nip points of the belt and pulley type. Please see figures.

## **Group 4: Projections on revolving parts**

(Figures on page 41)

Typical examples are coupling bolts, set screws on a revolving shaft or bar. Their potential for causing serious injuries is higher than the shafts, bars, etc. in Group 1. They can effectively be guarded by fixed enclosure guards or in the case of set screws, having them countersunk in the shaft or bar.

## **Group 5: Discontinuous rotating parts**

(Figures on page 42 to page 43)

Open-arm pulleys, fan blades, spoked flywheels etc. are examples of discontinuous rotating parts and they are dangerous. They can trap and twist or lacerate a person's hand or arm. Such parts can also grip clothing and through mere skin contact can force an arm or hand into a dangerous position, thus causing severe injury. They can be effectively guarded by fixed guards either of sheet metal or strong wire mesh construction.

## 第六類：旋轉打臂、有針滾筒、滾筒

(圖表載於第44頁)

旋轉打臂、有針滾筒及滾筒俱有高度危險性。就旋轉打臂及有針滾筒而言，該等機械內的移動部件，因同時進行旋轉與割切作用故造成危險。此等危險部件每每引致嚴重的斷肢事件。旋轉滾筒由於其旋轉部件體積大、速度高，故亦具危險性。

此類危險部件可加設固定式護罩予以有效防護。

## 第七類：設有孔口的罩壳內的旋轉混合器攪臂

(圖表載於第45頁)

旋轉混合器攪臂因有旋轉與攪拌作用，故具危險性。如手掌或手臂被旋動中的混合器攪臂捲着，可釀成極嚴重的意外。攪臂又可能將寬鬆的衣物纏繞，繼而將操作的工人拖入危險區內。

第45頁圖表所列舉的防護方法，乃使用互鎖式護罩，此法可確保當護罩蓋未關閉前，機械不能開動，而當護罩蓋打開時，機械即停止運作。

## **Group 6: Revolving beater, spiked cylinders, and revolving drums**

(Figures on page 44)

Revolving beaters, spiked cylinders and revolving drums are highly dangerous. In the case of revolving beaters and spiked cylinders, the danger is formed by the combination of rotary and cutting action of the moving parts in the machines. The revolving drums are dangerous due to the size and speed the rotating parts.

They can be effectively guarded by fixed enclosure guards.

## **Group 7: Revolving mixer arms in casings fitted with openings**

(Figures on page 45)

Revolving mixer arms are dangerous due to their rotary and beating action of the arms. They can cause very serious accident if a hand or arm is trapped by the revolving mixer arms. Loose clothing can be caught and it may then drag a person into a dangerous area.

The guarding example given in the figure on page 45 is an interlocking guard. It ensures that the machine cannot start until the cover is closed and that the machine is stopped when the guard cover is opened.

## 第八類：設有孔口的罩壳內的旋轉螺桿及螺旋

(圖表載於第46頁至第47頁)

螺旋或螺桿機械，在運轉時因旋轉螺旋與機械固定部件間產生剪切作用，故存有危險性。運轉的螺旋能將手掌或手臂捲曳，軋斷及壓碎。此種意外可能導致嚴重斷肢事件，第46頁圖表顯示使用長頸漏斗或倒鐘式護罩可將碎肉機的危險部件加以防護。在該兩種情況下，手指不能穿入螺旋空隙內。第47頁圖表說明使用安全漏斗可將塑膠擠出機的螺桿加以防護。

## 第九類：設有孔口的罩壳內的旋轉高速轉筒

(圖表載於第48頁)

旋轉高速轉筒因產生離心力，故極為危險。如轉筒載量過重或負重不平均時，情況尤為嚴重。特別是在保養不善的情況下，轉筒會有爆裂的危險。操作員的寬鬆衣物與旋轉轉筒接觸時，可能會被纏繞因而造成嚴重意外。

第48頁圖表顯示一部裝有互鎖式護罩的脫水機。



## **Group 8: Revolving worms and spirals in casings fitted with openings**

(Figures on page 46 to page 47)

In screw or worm mechanisms, the danger lies in the shearing action between the moving screw and the fixed parts of the machine. The screw action can drag, mangle and crush a hand or arm. This can sometimes lead to major amputation.

The figures on page 46 show that the dangerous part of a meat mincer can be guarded by a hopper guard or by an inverted bell guard. Entrance of fingers into the trapping area of the screw is not possible in both cases. The figures on page 47 show the guarding of the worm of a plastic extruder by a hopper guard.

## **Group 9: Revolving high-speed cages in casings fitted with openings.**

(Figures on page 48)

High-speed revolving cages are extremely dangerous because of the centrifugal force especially if the cage is over-loaded or unevenly loaded. Bursting of the cage may occur particularly when it has not been properly maintained. Loose clothing of the operative may be dragged by the revolving cage when in contact and lead to serious accidents.

The figures on page 48 show a hydroextractor which is fitted with an interlocking guard. Reliance on a loose or hinged cover alone does not satisfy the requirement of providing effective guarding.

## 第十類：旋轉切削工具

(圖表載於第49頁至第51頁)

切削圓刀、圓碟等均為此類危險部件的的實例。切削動作的危險在於切削工具的切口，因其容易導致嚴重的斷肢意外。

第49至51頁圖表顯示如何使用固定式護罩將銼刀加以有效防護及裝置長頸護罩或設有旋轉入料器的入料斗以防護塑膠碎料機的旋轉切刀。

## 第十一類：往復切削工具

(圖表載於第52頁至第54頁)

軋機於無防護情況下使用，具有相當危險性，尤以利用動力推動的軋刀，危險性更大。操作員在一瞬間不留神，亦足以引致嚴重意外。操作員不謹慎，及缺少適當訓練，亦為造成意外的原因。

此類危險部件的圖表顯示如何使用一個可調校的透明固定式護罩或光電安全裝置將紙軋加以防護，及裝置固定式金屬護罩以防護鐵片軋。

## **Group 10: Revolving cutting tools**

(Figures on page 49 to page 51)

Examples of this type of dangerous parts are circular cutters, circular shears, etc. The danger of cutting action exists at the cutting edge of the tool. Major amputation may result.

The figures on page 49 to 51 show how a milling cutter can be securely fenced by a fixed guard and a plastic granulator can be fenced either by a 'goose neck' hood guard or by a hopper fitted with a rotary feeding device.

## **Group 11: Reciprocating cutting tools**

(Figures on page 52 to page 54)

The guillotine is a dangerous machine when used in an unguarded state. The guillotine blade is particularly dangerous when operated by power. Even momentary inattention of the operator can result in serious accidents. Lack of care by the operator and absence of proper training also contribute to guillotine accidents.

The illustrations for this group show how a paper guillotine can be guarded by an adjustable perspex fixed guard or by a photoelectric safety device, and how a metal guillotine can be guarded by a fixed metal guard.

## 第十二類：往復壓具及衝模

(圖表載於第55頁至第56頁)

以五金啤機、油壓機及風壓機的壓具及衝模進行割切、成型與彎摺工作曾釀成為數甚多的手部及手指嚴重損傷事件。此等機械被公認為有危險性，因其引起極多嚴重問題。此等問題不但關乎如何防止意外，且關乎如何設計與發展可靠而健全的機械方法，將此類機械的壓具及衝模，加以有效防護。

為啤機裝置有效的護罩及保養為一項技術性工作，必須對該機械具備豐富知識及熟悉各類啤機意外的成因，方能確保操作安全。有些啤機雖已裝上適當護罩，惟因對護罩調整不正確或保養不善，意外仍有發生。

## 第十三類：往復走針

(圖表載於第57頁)

往復走針類的典型實例為衣車的車針。在製衣業內，此等車針造成無數手指損傷事件，尤以大量生產衣物而需使用極高速的電動衣車時為甚。快速的縫紉，加上車工的手指在極近危險區操作，均構成多宗縫針意外事件的成因。此等損傷性質雖不至嚴重，但身受者亦苦不堪言。

第57頁圖表顯示如何將衣車的車針加以適當防護。

## **Group 12: Reciprocating press tools and dies**

(Figures on page 55 to page 56)

The cutting, forming, and bending action at the tools and dies of power presses, hydraulic and pneumatic presses account for numerous serious hand and finger injuries. These machines are universally recognised as dangerous and have posed many serious problems in accident prevention as well as in designing and developing reliable and sound mechanical methods in the safe guarding of the tools and dies of these machines.

The fitting and maintenance of effective guards on power presses is a skilled job, and a sound knowledge of the machine as well as the causes of press accidents is necessary to ensure safe operation. Even for power presses which have been fitted with suitable guards, accidents still occur because of improper adjustment or poor maintenance of the guards.

## **Group 13: Reciprocating needles**

(Figures on page 57)

Sewing machines are typical examples of the reciprocating needles group. These machines are responsible for numerous finger injuries in the garment industry, especially when mass production of garment goods requires the use of very high speed power driven sewing machines. The fast sewing speed, plus the close proximity of the operator's fingers manoeuvring near the danger zone, is the major cause of many sewing needle injuries. Although the nature of such injuries may not be serious, the pain involved is considerable.

The figure on page 57 shows a sewing needle can be satisfactorily guarded.

## 第十四類：印壓運行之間的閉合夾口

(圖表載於第58頁)

在塑膠壓注機兩模相合時存在的夾口，曾造成多宗嚴重意外，引致手掌或手臂夾斷。意外的發生通常是由於工人試行用手清除阻梗在工模上的塑膠工件時，意外觸動控制印壓工模關閉循環的光電裝置，或當印壓工模正在關閉時，試行伸手觸摸工模區。打開的印壓工模，也會常因機器上的微型電掣發生故障而突然關閉，如該操作員未能及時將手抽回，手部則受重傷。其他機械例子為「照鏡」印刷機，啤盒機及合金壓鑄機。

## 第十五類：突出的傳動帶緊固件及快速運轉傳動帶

(圖表載於第59頁)

當人體任何部分與突出傳動帶緊固件接觸時，會造成擦傷。這些突出的傳動帶緊固件亦能將寬鬆衣物鉤着，因而將該工人拖着及繞着傳動帶的滑輪與轉軸。快速運轉傳動帶亦同樣有潛伏的危險，可造成嚴重意外與損傷。這類危險部件可以固定式護罩有效地防護，此亦即上述第三類防護機械危險部件的單件護罩。

## **Group 14: Closing nips between platen motions**

(Figures on page 58)

The trapping area between closing moulds of plastic injection moulding machines has caused many serious accidents resulting in the mutilation of a hand or an arm. Accidents often occur when the operator is trying to use his hand to remove a moulded article jammed on a mould and accidentally triggers off the photoelectric device controlling the closing cycle of the mould platen, or is trying to reach the mould area when the platen is closing. It is not uncommon that the opened platen may suddenly close due to faults developing in micro switches on these machines. If the operator cannot withdraw his hand in time, it will be seriously injured. Other examples are platen presses, paper-embossing machines and die casting machines.

## **Group 15: Projecting belt fasteners and fast running belts**

(Figures on page 59)

Projecting belt fasteners cause abrasion injuries when any part of a person's body comes into contact with them. They can also hook onto the person's loose clothing, thus dragging him onto and around the belt's pulleys and shaftings. Fast running belts have similar potential for causing serious accidents and injuries. They can be effectively guarded by fixed guards which may also be single-piece guards for the parts in Group 3.

## 第十六類：連結桿或連結環節之間及回轉輪曲柄 或衝模之間的夾口

(圖表載於第60頁)

各連結桿或連結環節之間的空隙均為危險區，可造成嚴重傷害。此等部件應安裝固定式護罩加以有效防護。護罩可設有互鎖式開啟部分，使機器在停頓後，操作員才能接觸經常須要潤滑的機器部件。

## 第十七類：自動機器的移動支架所造成的陷阱

(圖表載於第61頁)

在計劃安放機械時，最重要是應使自動機器的移動支架與固定物體之間（例如牆壁及柱等）不致形成危險區域。當機器的移動部件移近一固定物體（例如柱）時，即出現一危險區。在計劃或再次部署安放機械時，須經常注意避免此類危險區的形成。如在事後發覺有危險陷阱存在，應加設防護桿條（或導板），使人不致進入因往復移動支架移近固定物體所形成的空間。



## **Group 16: Nips between connecting rods or links, and rotating wheel cranks or discs**

(Figures on page 60)

The nips between the connecting rods / links and rotating wheel cranks / discs are dangerous points and can lead to serious injury. Such areas can be guarded effectively by fixed guards which can be designed to have interlocking hinged sections so that access to parts requiring frequent lubricating can be made when the machine has been switched off.

## **Group 17: Traps arising from the traversing carriages of self-acting machines**

(Figures on page 61)

In the planning stage, it is important that the layout of the machinery does not cause a trapping area between a traversing carriage of self-acting machine and a fixed object such as wall or column. There is a point of danger where the moving part of the machine approaches a fixed object (e.g. a column). Always try to spot and eliminate such danger during planning or replanning of layout. Should such trapping danger be found afterwards, guard bars (or guides) can be added so that no person can go in between the pinch point created by the reciprocating slide when approaching the fixed object.

## 4. 圖例 Examples and Figures

第一類：旋轉軸、聯結器（啞輪）、心軸、芯棒、桿條及飛輪

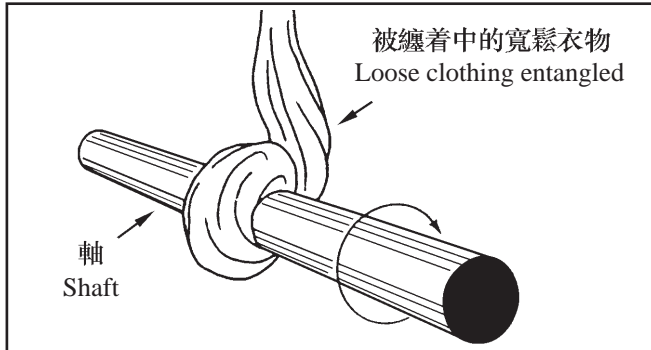
例如：主軸與副軸、機軸、鑽軸、鑽咀及夾頭、工料桿、橫軸。

**Group 1: Revolving shafts, couplings, spindles, mandrels, bars and flywheels**

Examples: Line and counter shafts; machine shafts; drill spindles; chucks and drills etc; stock-bars; traverse shafts.

第一類：並未防護

**GROUP 1: UNGUARDED**

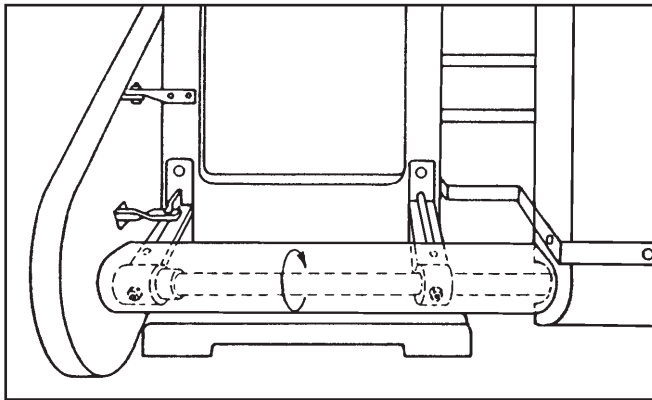


第一類：已被防護

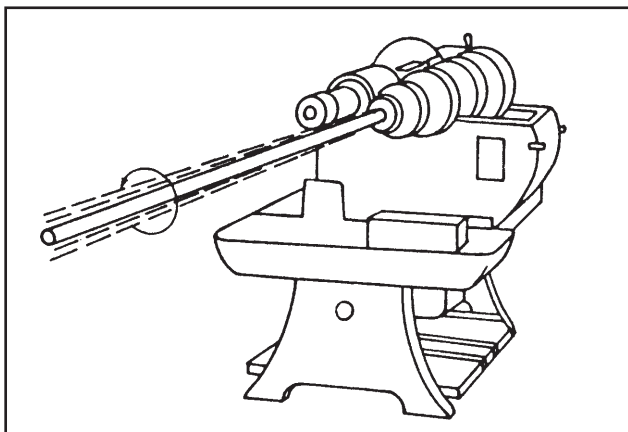
**GROUP 1: GUARDED**

轉軸已被防護

Shaft guarded

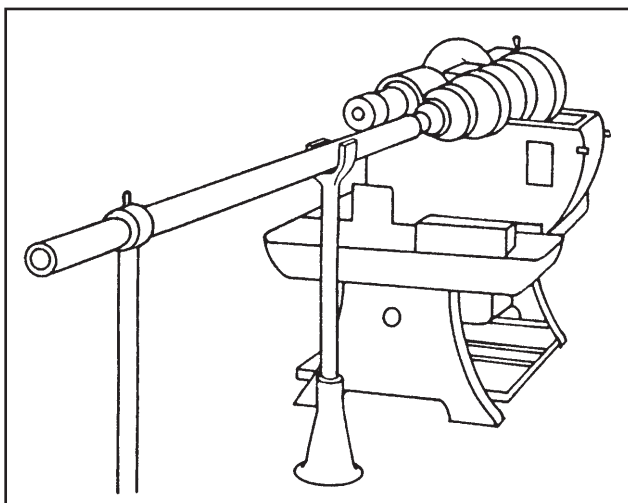


第一類： 並未防護  
GROUP 1: UNGUARDED



沒有防護的旋轉工  
料桿  
Unguarded revolving  
stock-bar

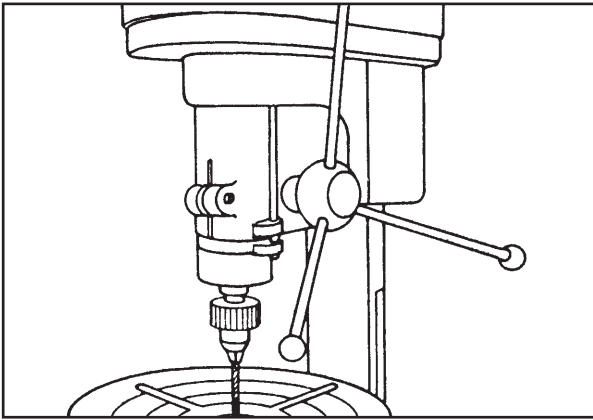
第一類： 已被防護  
GROUP 1: GUARDED



用於旋轉工料桿的  
護罩  
Revolving stock-bar  
guard

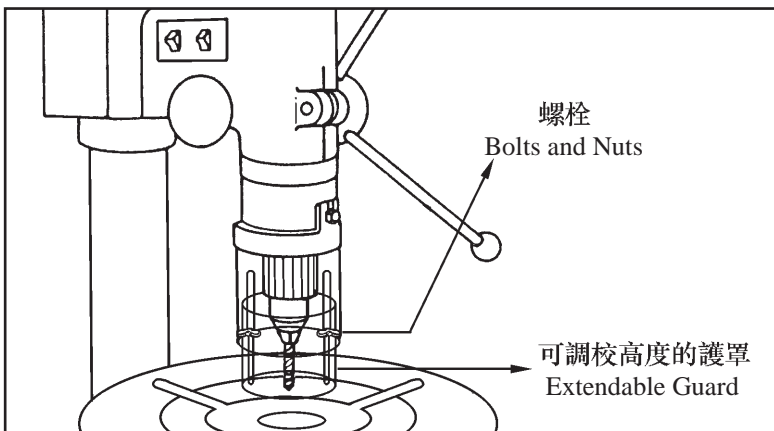
第一類： 並未防護  
**GROUP 1: UNGUARDED**

鑽咀夾頭  
Drill spindle



第一類： 已被防護  
**GROUP 1: UNGUARDED**

鑽咀夾頭已被可調校高度的透明護罩防護  
Transparent extendable perspex guard provided



第二類：一對旋轉部件之間的轉入夾口

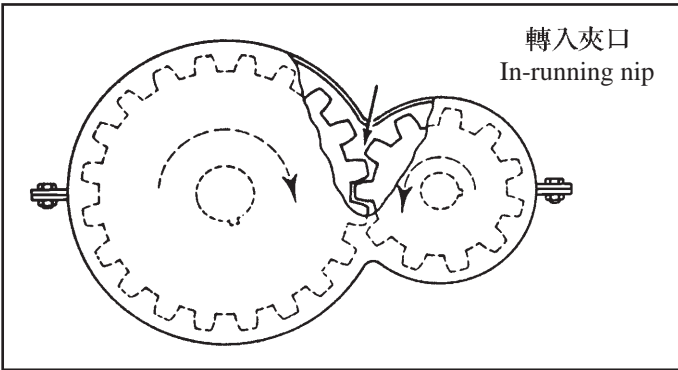
例如：齒輪、摩擦輪、滾筒、壓榨滾筒、軋片機、膠軋、麵團軋機、印刷機、造紙機。

**Group 2: In-running nips between pairs of rotating parts**

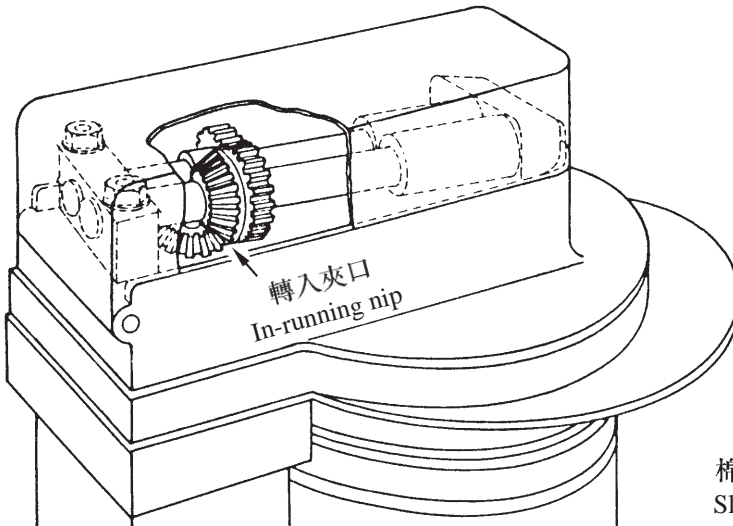
Examples: Gear wheels; friction wheels; calender bowls; mangle rolls; metal manufacturing rolls; rubber washing, breaking and mixing rolls; dough brakes; printing machines; paper making machines.

第二類：已被防護

**GROUP 2: GUARDED**



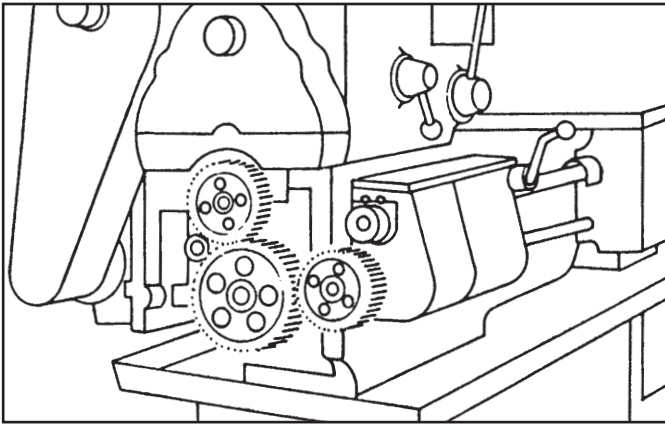
齒輪  
Gears



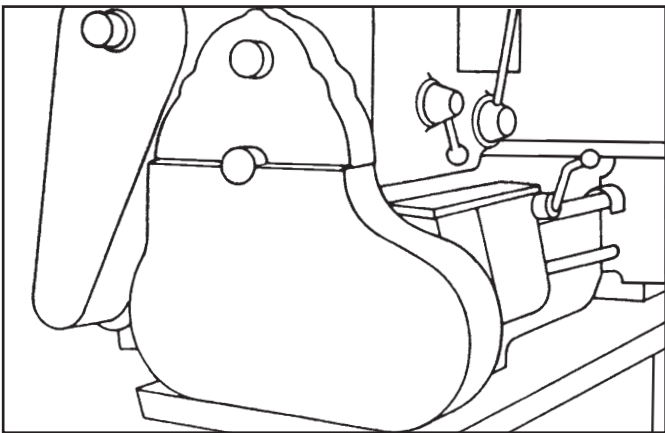
棉條卷筒  
Sliver coiler

第二類： 並未防護  
**GROUP 2: UNGUARDED**

齒輪之間的轉入夾口  
In-running nip between gears

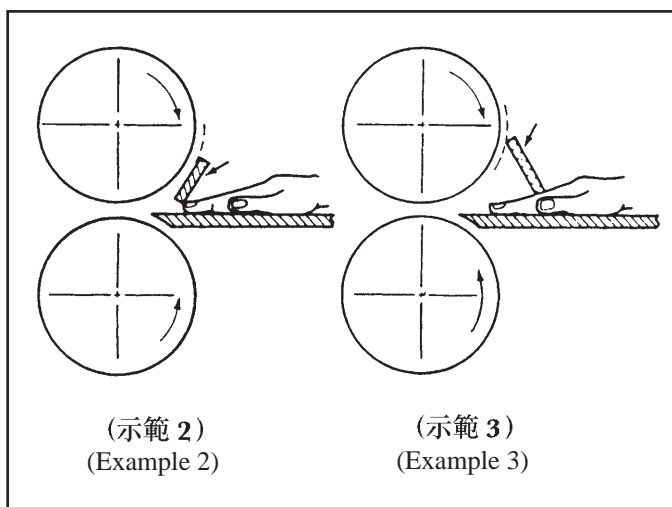
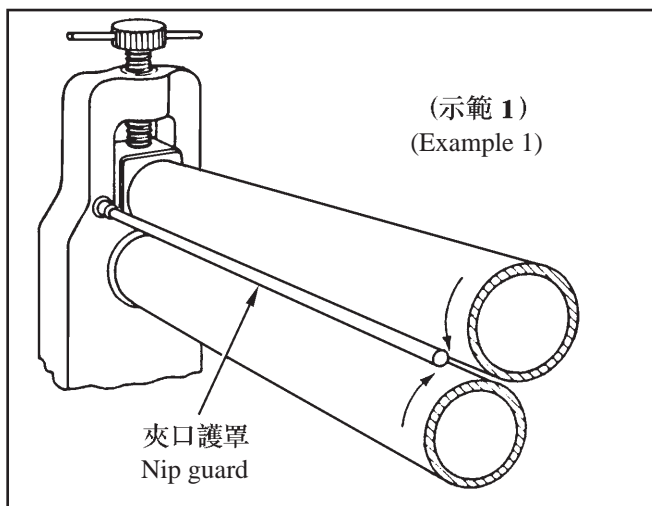


第二類： 已被防護  
**GROUP 2: GUARDED**



第二類： 已被防護  
GROUP 2: GUARDED

滾筒夾口護罩  
Nip guard for rollers



第三類：傳動帶滑輪組的轉入夾口

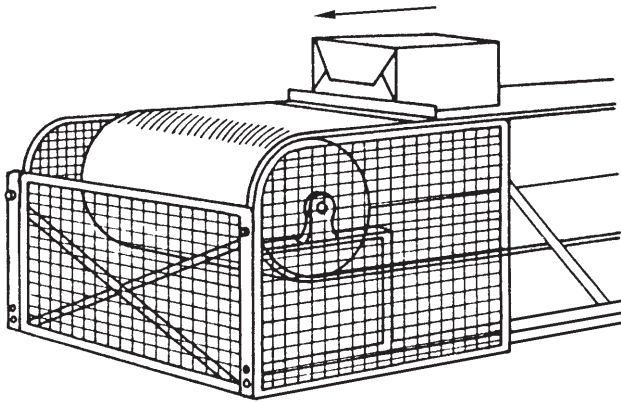
例如：傳動帶及滑輪（平面，凸緣或凹坑式）、鍊帶及鍊輪、運輸帶及滑輪等等。

**Group 3: In-running nips of the belt and pulley type**

Examples: Belts and pulleys (plain, flanged or grooved); chain and sprocket wheels; conveyor belts and pulleys and the like.

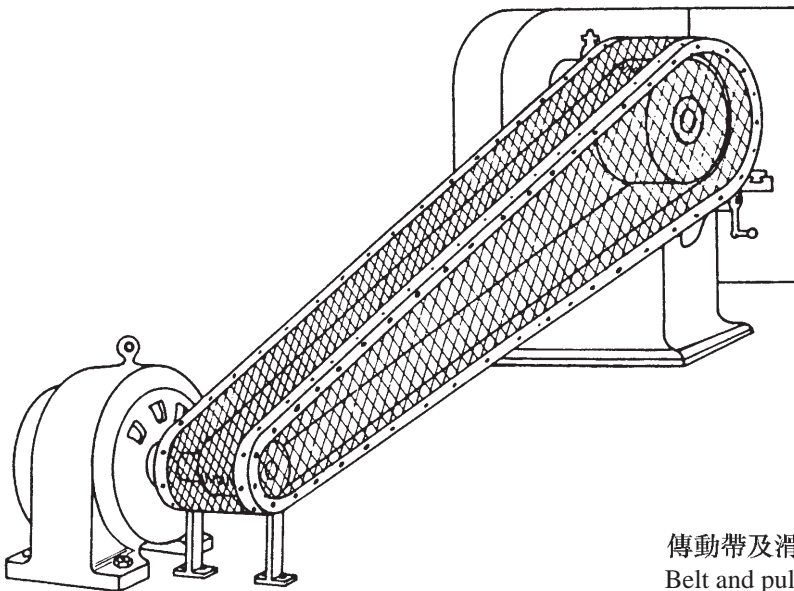
第三類：已被防護

**GROUP 3: GUARDED**



運輸帶末端

Conveyor belt end



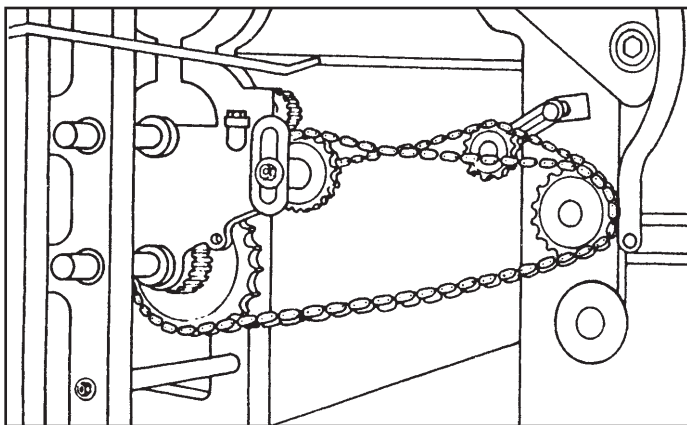
傳動帶及滑輪

Belt and pulley



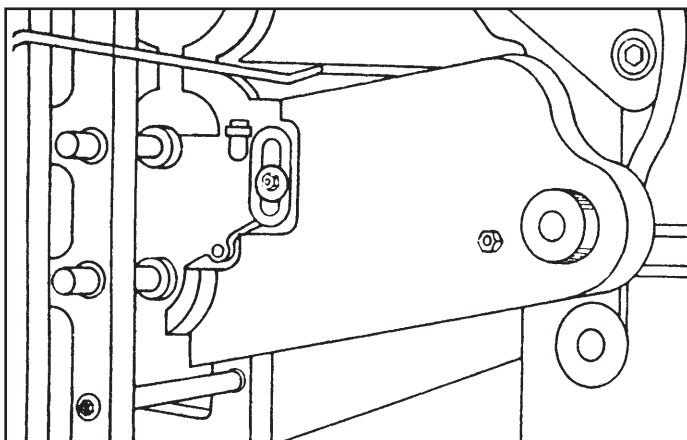
第三類： 並未防護  
**GROUP 3: UNGUARDED**

鏈輪與鏈的轉入夾口  
In-running nips between the chains and sprocket wheels



暴露在印刷機底  
部的鏈輪與鏈  
Exposed chains  
and sprocket  
wheels  
underneath  
printing machine

第三類： 已被防護  
**GROUP 3: GUARDED**

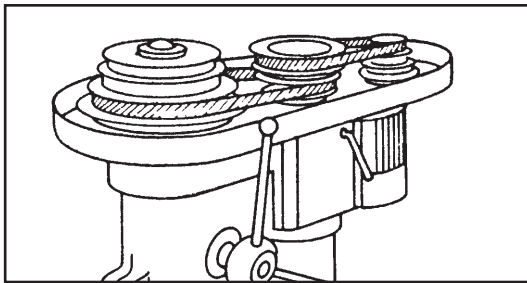


第三類： 並未防護

**GROUP 3: UNGUARDED**

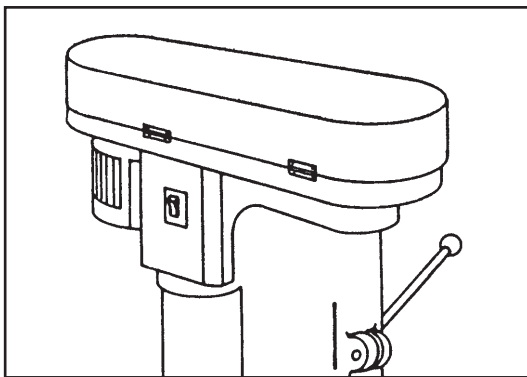
傳動帶及滑輪的轉入夾口

In-running nips between the belts and pulleys



第三類： 已被防護

**GROUP 3: GUARDED**



第四類：轉動部件的突出部分

例如：楔頭、定位螺絲、定位栓、聯結器（啣輪）螺栓。

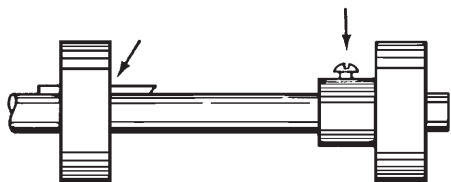
**Group 4: Projections on revolving parts**

Examples: Key-heads; set screws; cotter pins; coupling bolts.

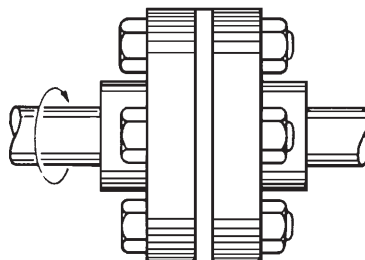
第四類：並未防護

**GROUP 4: UNGUARDED**

突出的楔頭及定位螺絲  
Projecting key & set screw

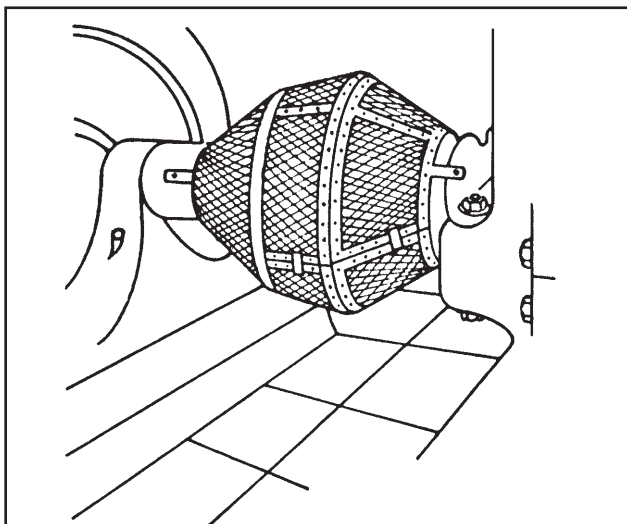


聯結器螺栓  
Coupling bolts



第四類：已被防護

**GROUP 4: GUARDED**



第五類：斷續旋轉部件

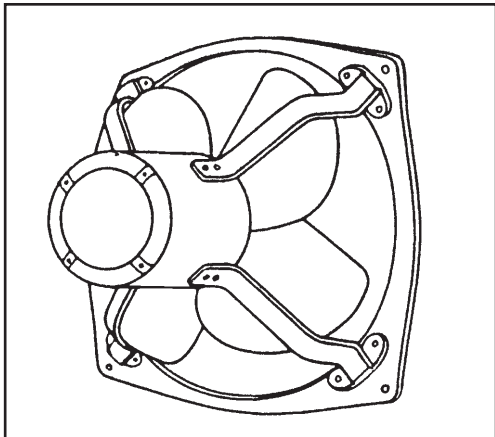
例如：輻輪、風扇葉、輻枝齒輪、輻枝飛輪。

**Group 5: Discontinuous rotating parts**

Examples: Open arm pulleys; fan blades; spoked gear wheels, and spoked flywheels

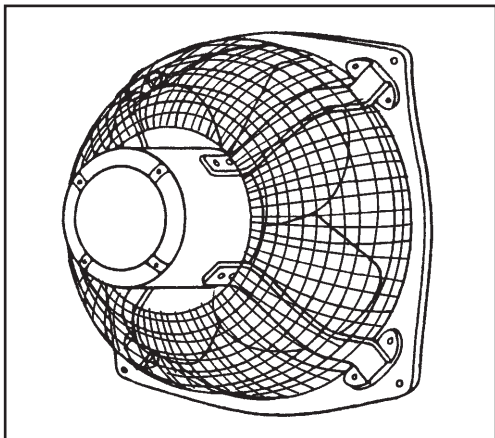
第五類：並未防護

**GROUP 5: UNGUARDED**



第五類：已被防護

**GROUP 5: GUARDED**

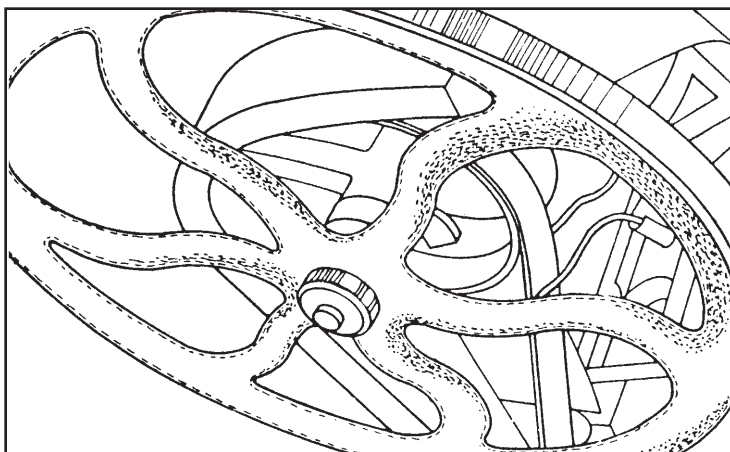


固定式護罩

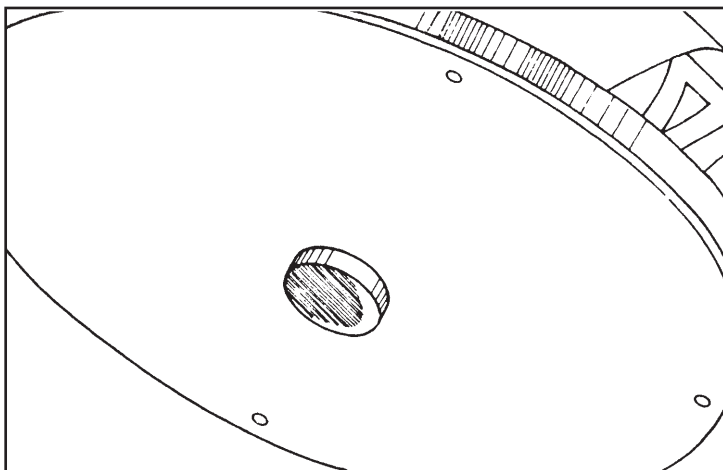
Fixed guard

第五類： 並未防護  
GROUP 5: UNGUARDED

斷續旋轉部件 —— 輪輻  
Discontinuous rotating part – spokes of flywheel



第五類： 已被防護  
GROUP 5: GUARDED



第六類：旋轉打臂、有針滾筒、滾筒

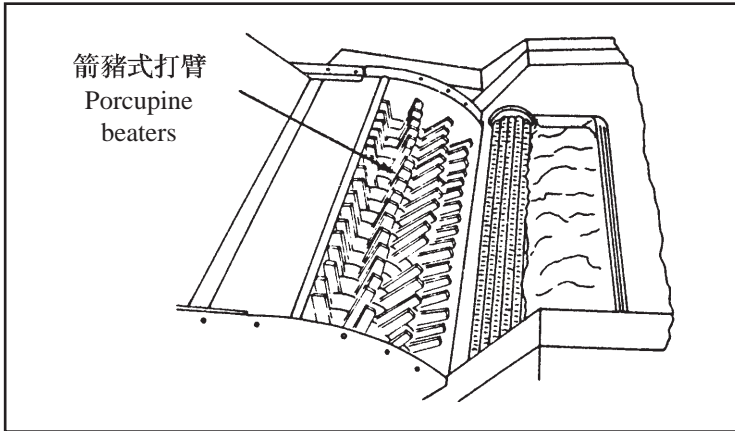
例如：清花機、威士機、開棉機、梳棉機、洗衣機。

**Group 6: Revolving beaters, spiked cylinders, and revolving drums**

Examples: Scutchers; rag-flock teasers; cotton openers; carding engines; laundry washing machines.

第六類：並未防護

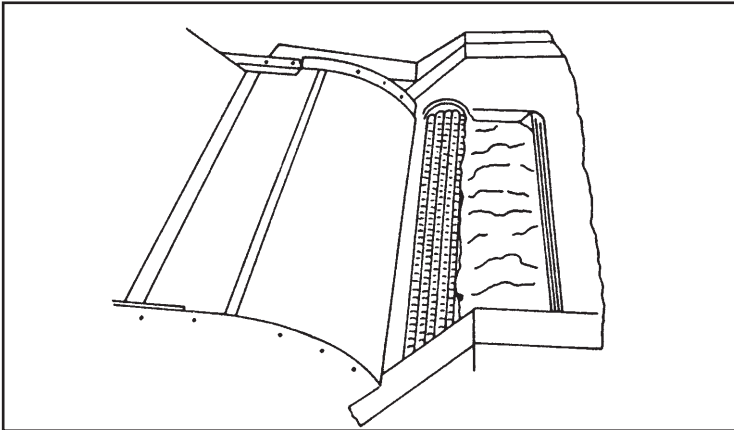
**GROUP 6: UNGUARDED**



清花機  
Scutcher

第六類：已被防護

**GROUP 6: GUARDED**



第七類：設有孔口的罩壳內的旋轉混合器攪臂

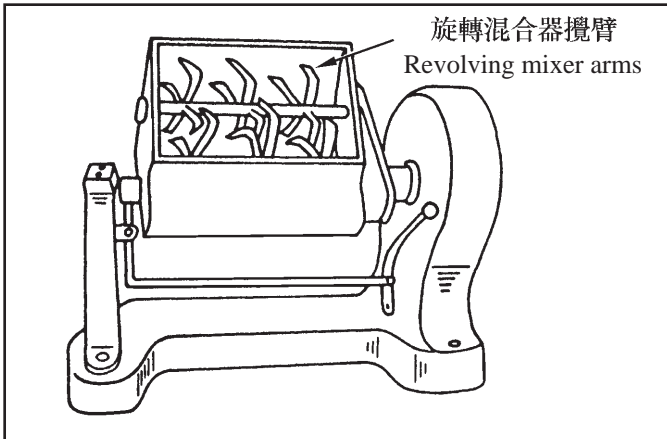
例如：麵團混合器、膠漿混合器

**Group 7: Revolving mixer arms in casings fitted with openings**

Examples: Dough mixers; rubber solution mixers

第七類：並未防護

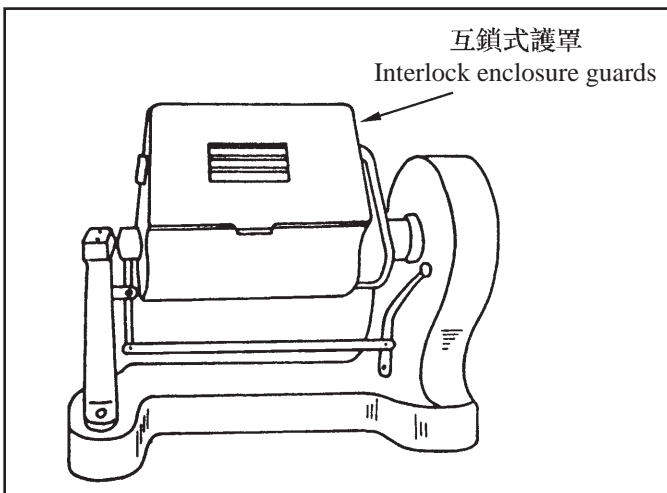
**GROUP 7: UNGUARDED**



碎料混合器  
Granule Mixer

第七類：已被防護

**GROUP 7: GUARDED**



第八類：設有孔口的罩壳內的旋轉螺桿及螺旋

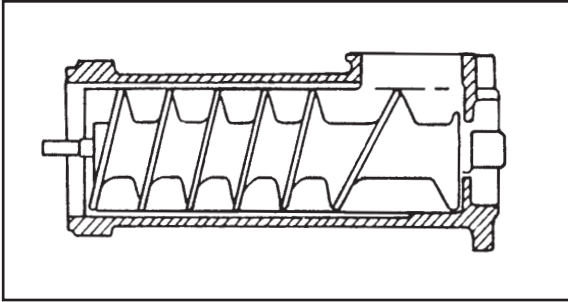
例如：碎肉機、出膠機、螺旋運輸槽。

**Group 8: Revolving worms and spirals in casings fitted with openings**

Examples: Meat mincers; rubber extruders; spiral conveyors.

第八類：並未防護

**GROUP 8: UNGUARDED**

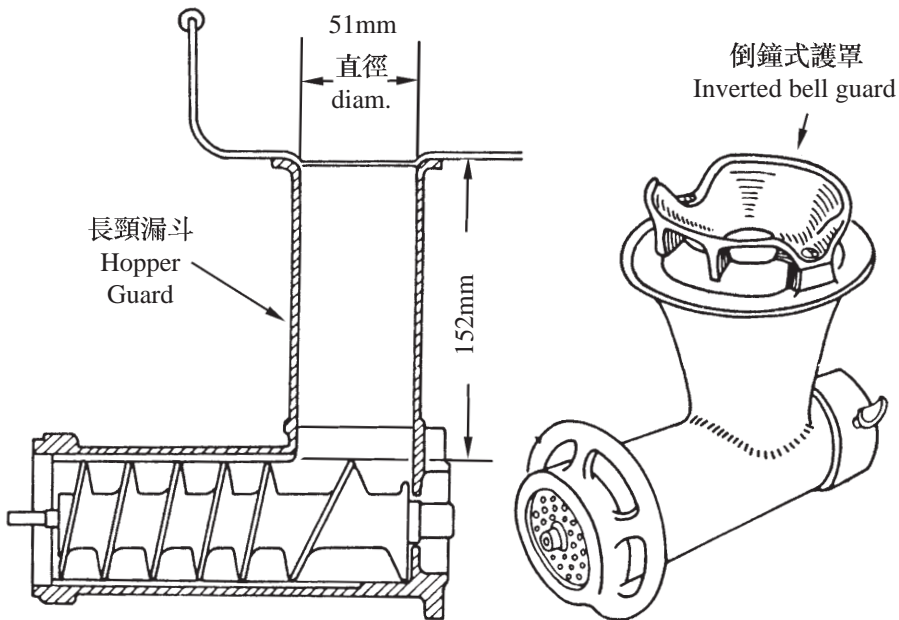


碎肉機

Meat mincer

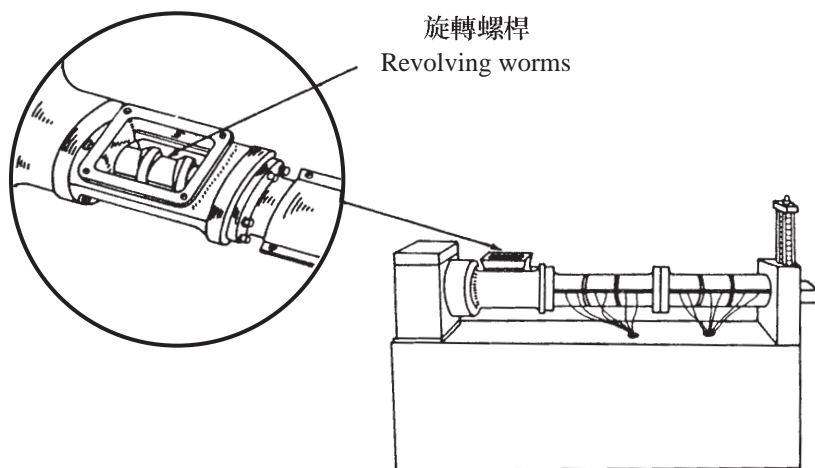
第八類：已被防護

**GROUP 8: GUARDED**



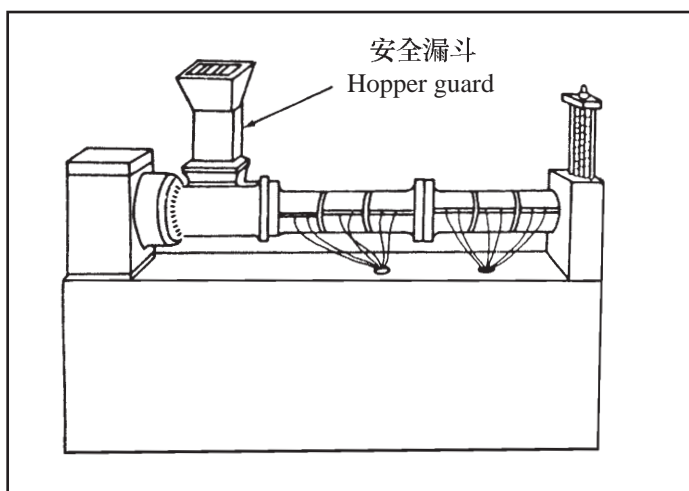


第八類： 並未防護  
GROUP 8: UNGUARDED



塑膠擠出機  
Plastic extruder

第八類： 已被防護  
GROUP 8: GUARDED



第九類：設有孔口的罩壳內的旋轉高速轉筒

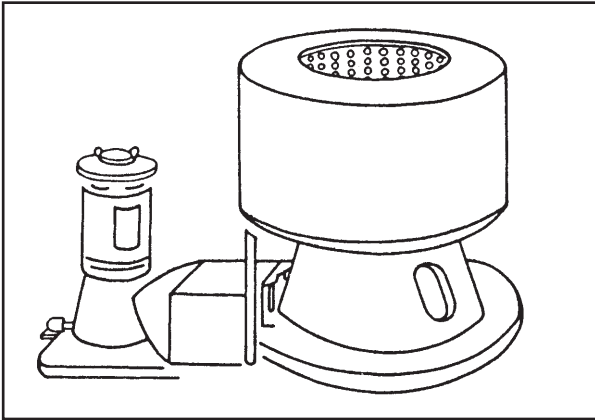
例如：脫水機、離心機。

**Group 9: Revolving high-speed cages in casings fitted with openings.**

Examples: Hydroextractors, centrifuges

第九類：並未防護

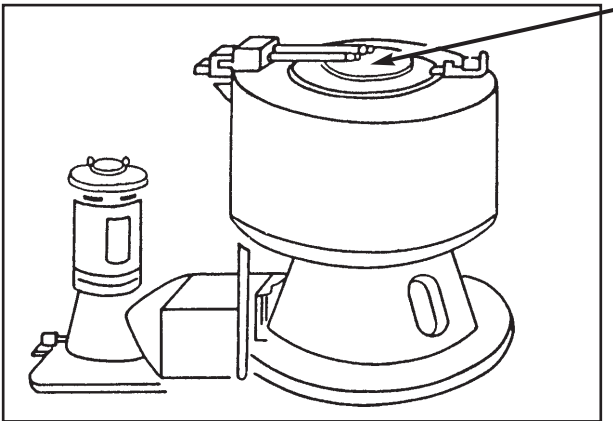
**GROUP 9: UNGUARDED**



旋轉轉筒  
Revolving cage

第九類：已被防護

**GROUP 9: GUARDED**



互鎖式護罩  
Interlocking guard

蓋未關好，機不能  
開動；旋轉轉筒未  
停定，蓋不能開

Machine cannot be  
operated until cover is  
in position. Cover  
cannot be lifted until  
cage is at rest.

第十類： 旋轉切削工具

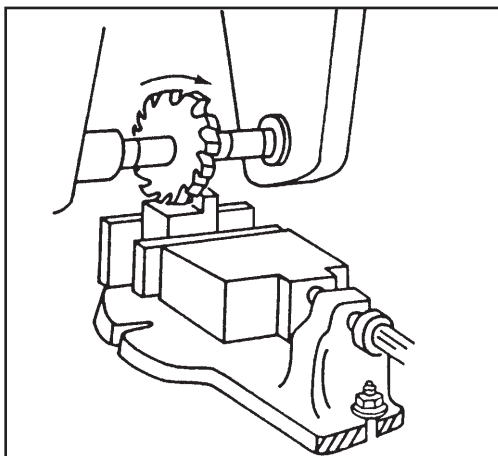
例如： 銑刀、切削圓碟。

**Group 10: Revolving cutting tools.**

Examples: Milling cutters; circular shears

第十類： 並未防護

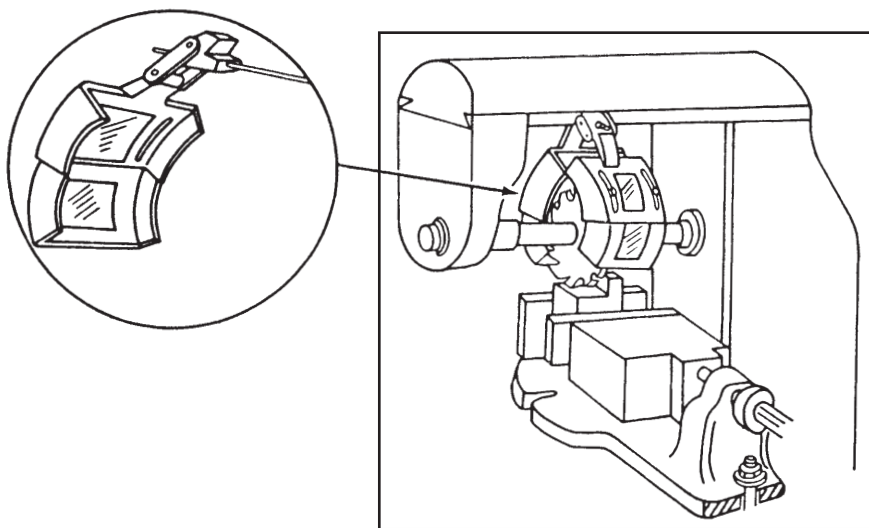
**GROUP 10: UNGUARDED**



銑刀  
Milling cutter

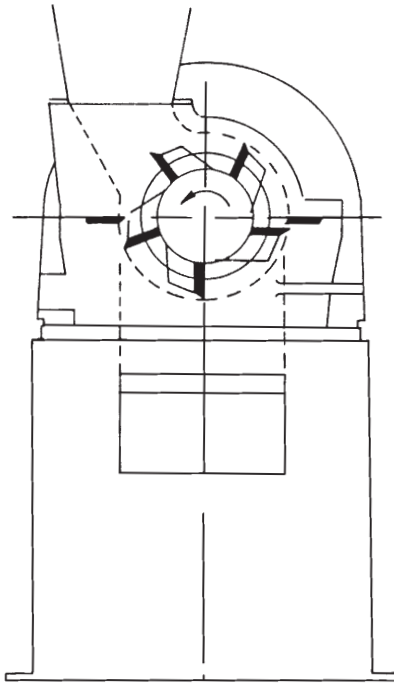
第十類： 已被防護

**GROUP 10: GUARDED**

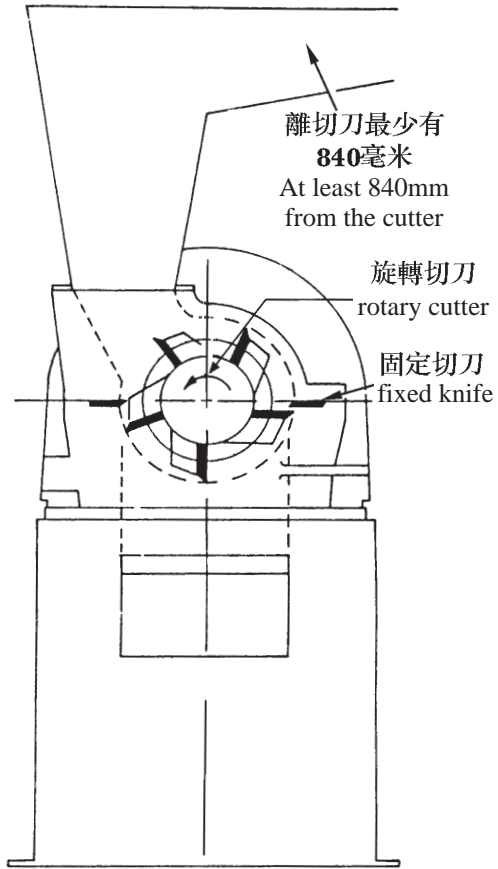


第十類： 並未防護  
GROUP 10: UNGUARDED

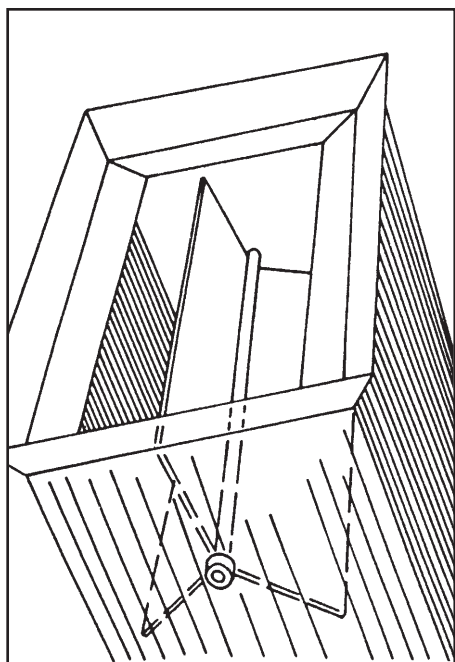
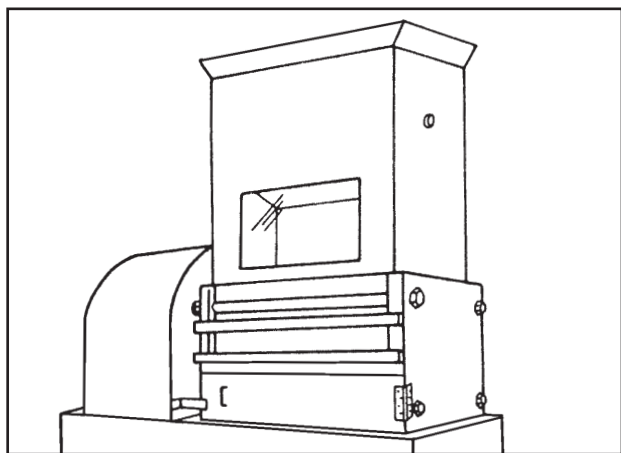
第十類： 已被防護  
GROUP 10: GUARDED



塑膠碎料機  
Plastic granulator



第十類： 已被防護  
GROUP 10: GUARDED



旋轉切削工具 — 被入料斗防護  
的塑膠碎料機旋轉切刀，該斗口  
部裝有旋轉入料器，以防手部進  
入危險地方

Revolving cutting tools— rotating  
cutter in plastic granulator being  
guarded by hopper fitted with a  
rotary feeding device which  
prevents the entrance of fingers  
into the dangerous area

第十一類：往復切削工具

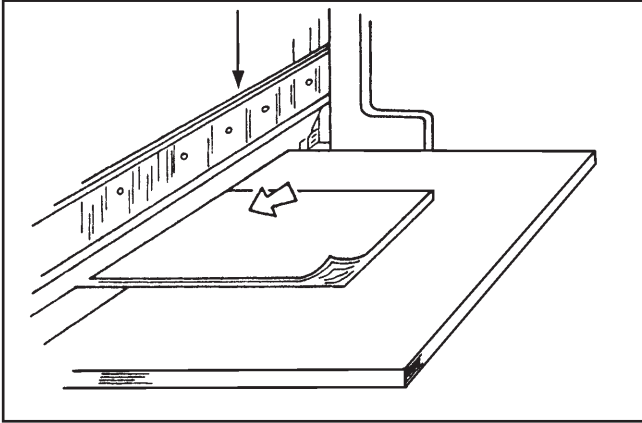
例如：五金／膠片／紙的軋機、切邊機、軋角機、打孔機。

**Group 11: Reciprocating cutting tools**

Examples: Guillotines for metal, rubber and paper; trimmers; corner cutters; perforators.

第十一類：並未防護

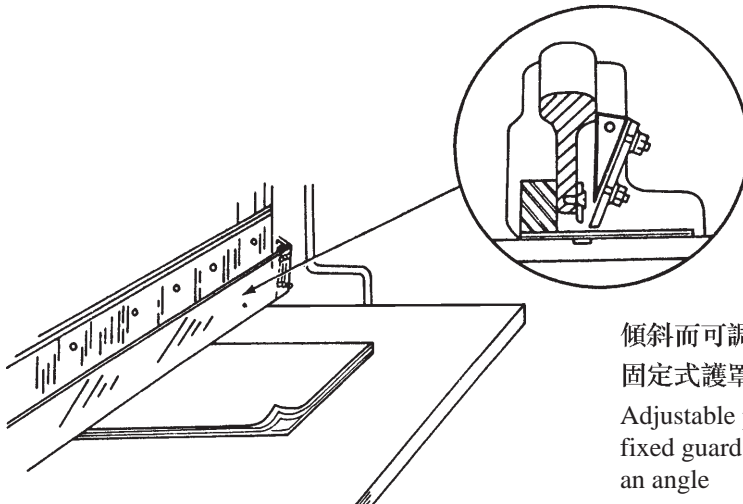
**GROUP 11: UNGUARDED**



紙軋  
Paper Guillotine

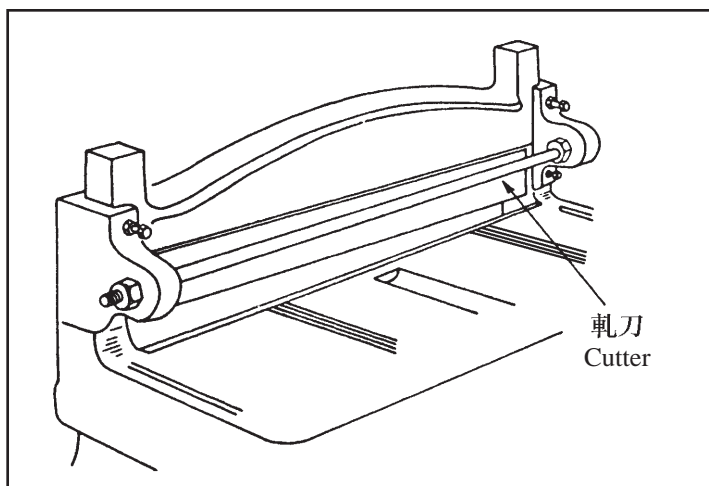
第十一類：已被防護

**GROUP 11: GUARDED**



傾斜而可調校的透明  
固定式護罩  
Adjustable perspex  
fixed guard inclined at  
an angle

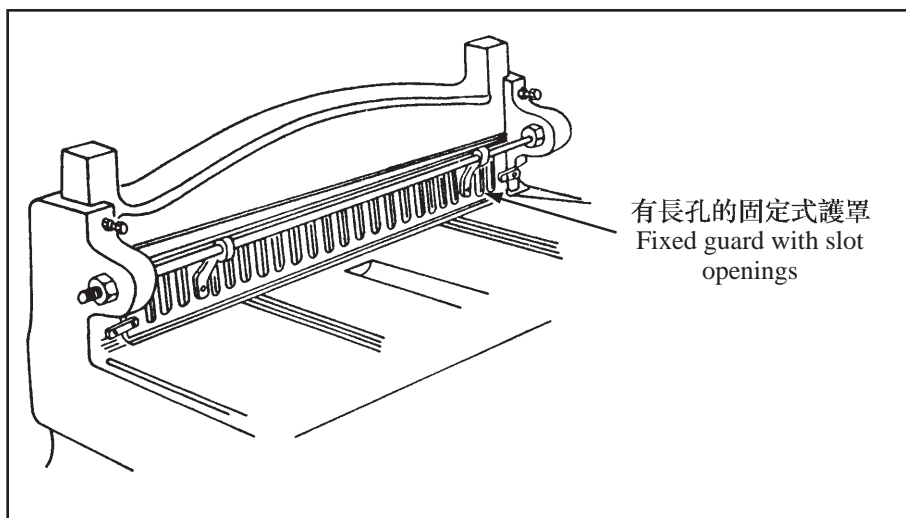
第十一類：並未防護  
GROUP 11: UNGUARDED



軋刀  
Cutter

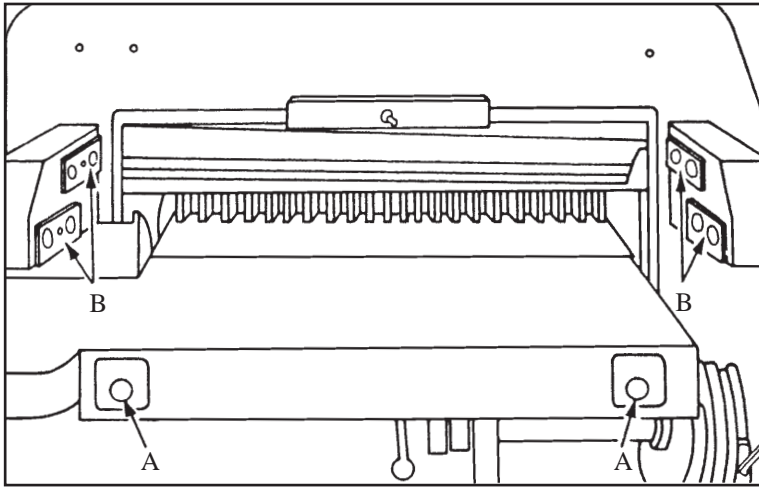
鐵片軋  
Metal Guillotine

第十一類：已被防護  
GROUP 11: GUARDED



有長孔的固定式護罩  
Fixed guard with slot  
openings

第十一類：已被防護  
GROUP 11: GUARDED



往復切刀——裝有電眼的紙軋，並加雙手按掣的安全系統  
Reciprocating knives — paper guillotine guarded by photoelectric safety device  
coupled with two-hand control buttons for additional safety.

雙手按掣

A — two-hand control buttons

光電安全裝置（電眼）

B -- photoelectric safety device (electric eye)



第十二類：往復壓具及衝模

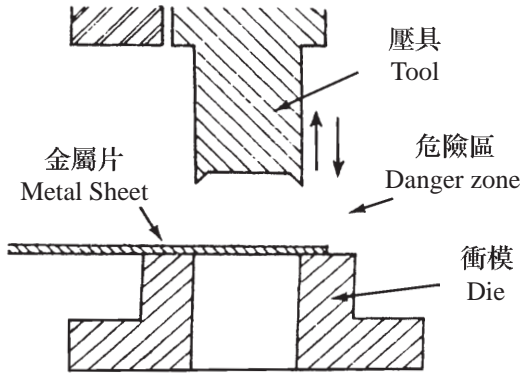
例如：五金啤機、衝鎚、油壓機、風壓機、摺床。

Group 12: Reciprocating press tools and dies

Examples: Power presses; drop stamps; hydraulic and pneumatic presses; bending presses.

第十二類：並未防護

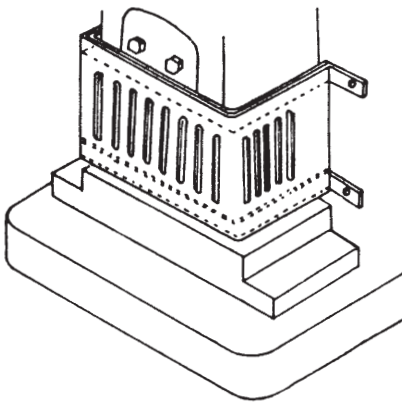
GROUP 12: UNGUARDED



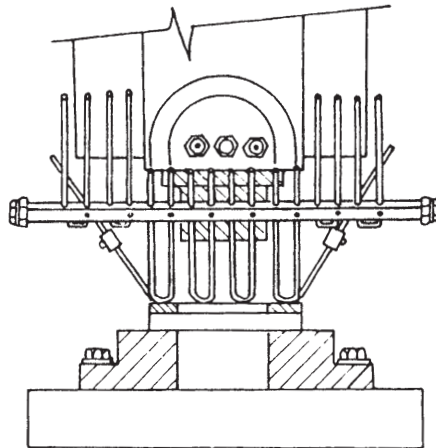
五金啤機  
Power press

第十二類：已被防護

GROUP 12: GUARDED

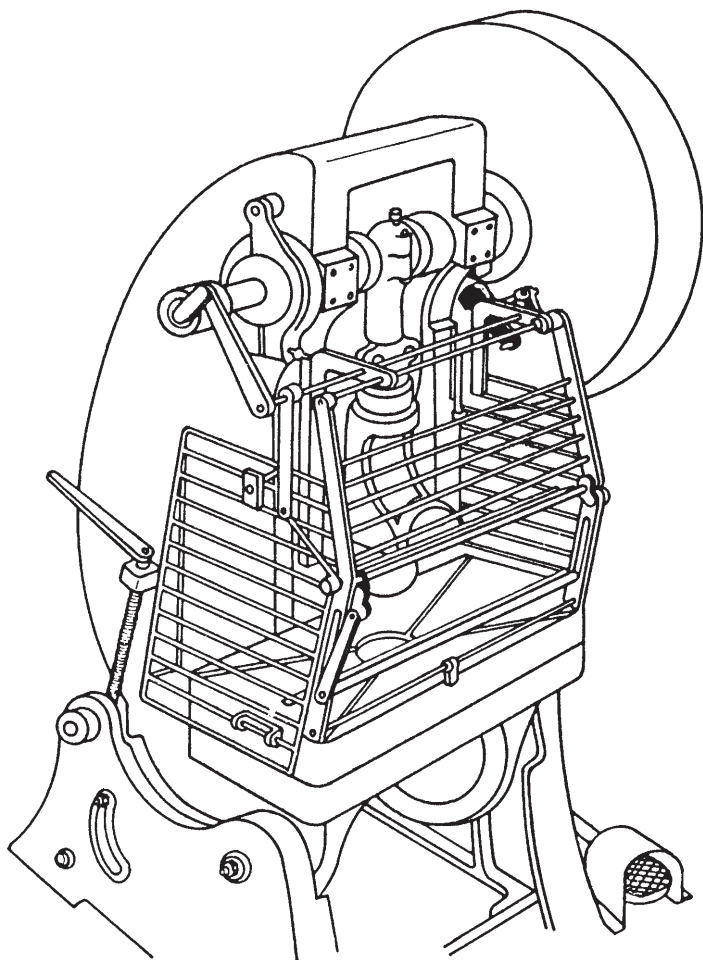


固定式護罩 (示範 1)  
Fixed Guard (example 1)



固定式護罩 (示範 2)  
Fixed Guard (example 2)

第十二類：已被防護  
GROUP 12: GUARDED



五金啤機（配上互鎖式護罩）  
Power press (guarded with interlocking guard)

第十三類：往復走針

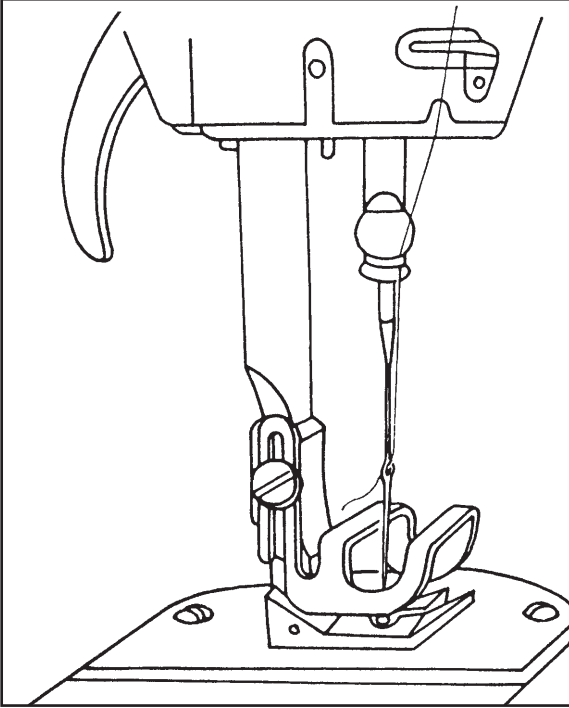
例如：衣車的車針（單針及複針）。

**Group 13: Reciprocating needles**

Examples: Single and multiple needles on sewing machines.

第十三類：已被防護

**GROUP 13: GUARDED**



衣車的車針（單針及複針）皆可加設簡單的護罩，以作防護。此等護罩，可如圖示以螺絲固定，並能適應多種工作，又不會妨礙正常生產。

Single and multiple needles on sewing machines can be guarded by simple guard as shown. It is suitable for almost all types of work without interfering with efficient production.

第十四類：印壓運行之間的閉合夾口

例如：“照鏡”印刷機、啤盒機、合金壓鑄機、塑膠壓注機。

**Group 14: Closing nips between platen motions**

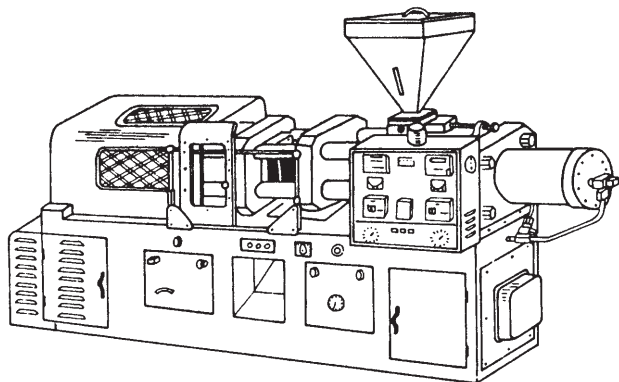
Examples: Platen presses; paper-embossing machines; die-casting machines; plastic injection moulding machines.

第十四類：並未防護

**GROUP 14: UNGUARDED**

(沒有籠式模罩)

(Cage guard not provided)



塑膠壓注機

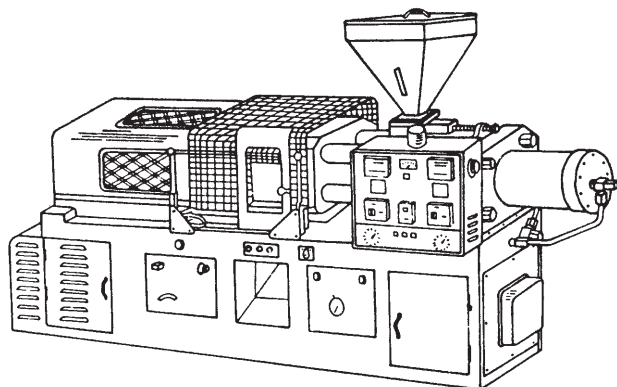
Plastic injection  
moulding machine

第十四類：已被防護

**GROUP 14: GUARDED**

(裝有籠式模罩)

(Cage guard fitted)



第十五類：突出的傳動帶緊固件及快速運轉傳動帶

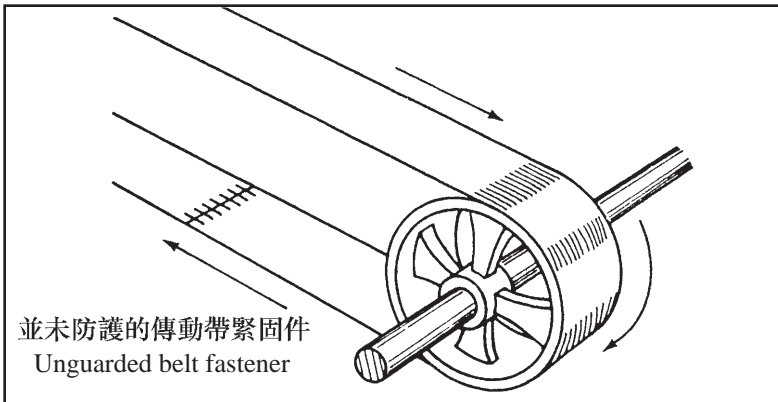
例如：螺栓和螺帽緊固件、金屬線緊固件、木工機械傳動帶、離心機傳動帶、紡織機械的側面傳動帶。

**Group 15: Projecting belt fasteners and fast running belts**

Examples: Bolt and nut fasteners; wire pin fasteners and the like; woodworking machinery belts; centrifuge belts; textile machinery side belting.

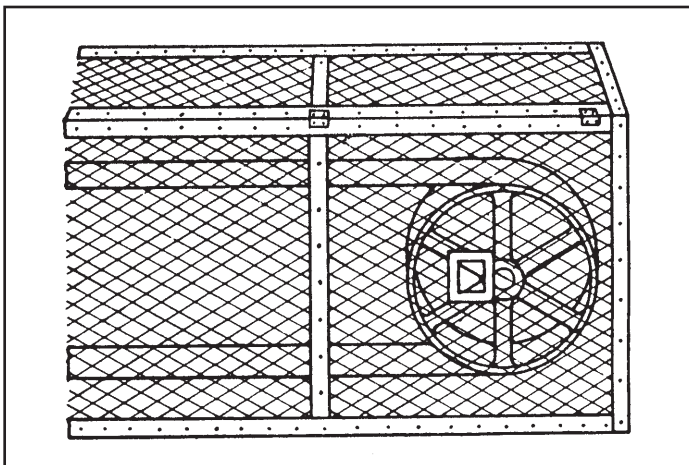
第十五類：並未防護

**GROUP 15: UNGUARDED**



第十五類：已被防護

**GROUP 15: GUARDED**



第十六類：連結桿或連結環節之間及回轉輪曲柄或衝模之間的夾口

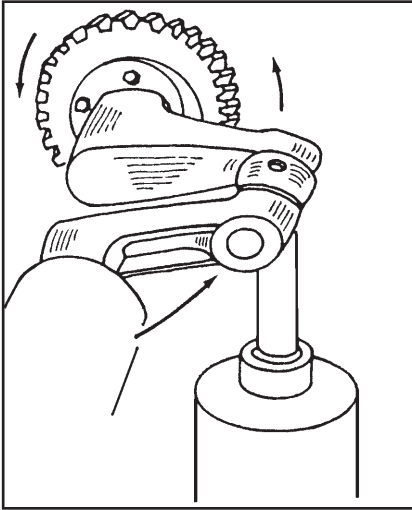
例如：滾筒印刷機側面推動部分、提花織機推動部分、臥式衝床、平台毛織機。

**Group 16: Nips between connecting rods or links, and rotating wheel cranks or discs**

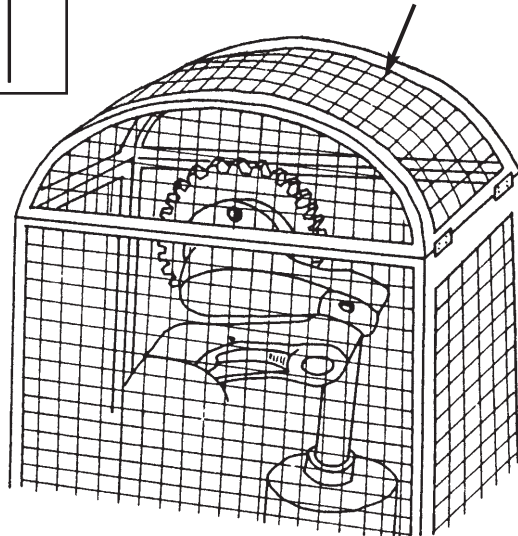
Examples: Side motions of certain flat-bed printing machines; Jacquard motions on looms; horizontal deep drawing machines; flat woollen knitting machines.

第十六類：並未防護

**GROUP 16: UNGUARDED**



可開啟的固定式護罩  
Hinged guard



第十六類：已被防護

**GROUP 16: GUARDED**

第十七類：自動機器的移動支架所造成的陷阱

例如：刨床。

**Group 17: Traps arising from the traversing carriages of self-acting machines**

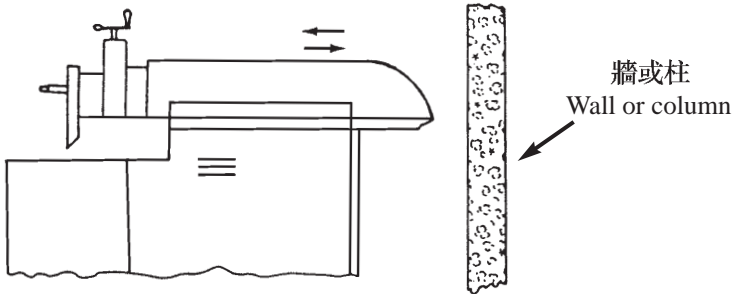
Examples: Shaping machines.

第十七類：並未防護

**GROUP 17: UNGUARDED**

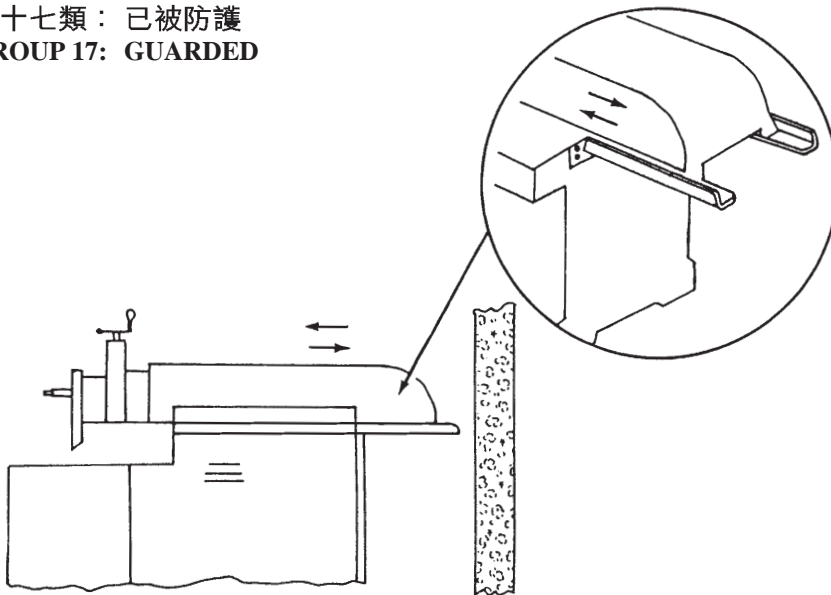
往復機件與固定物體之間的夾口

Reciprocating mechanism creating pinch point at fixed object



第十七類：已被防護

**GROUP 17: GUARDED**



## 5. 資料查詢

如你對本手冊有任何疑問或想查詢其他職業安全及健康事宜，你可與職業安全及健康部聯絡：

電話       ： **2559 2297**（辦公時間外，將會自動錄音）

傳真       ： **2915 1410**

電子郵件   ： **enquiry@labour.gov.hk**

你亦可以透過互聯網，找到勞工處提供的各項服務及主要勞工法例的資料。本處的網址是

**<http://www.info.gov.hk/labour>**。



## 5. Useful Information

If you wish to enquire about this handbook or require advice on occupational safety and health, you can contact the Occupational Safety and Health Branch through:

Telephone : 2559 2297 (auto-recording after office hours)

Fax : 2915 1410

E-mail : [enquiry@labour.gov.hk](mailto:enquiry@labour.gov.hk)

Information on the services offered by the Labour Department and on major Labour legislation can also be found by visiting our website <http://www.info.gov.hk/labour>.