Candidate Name	Centre Number	Candidate Number

OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

General Certificate of Secondary Education

DESIGN AND TECHNOLOGY (SYSTEMS AND CONTROL TECHNOLOGY)

1957/5

PAPER 5: PNEUMATICS
FOUNDATION TIER

Specimen Paper 2003

Additional materials: Formulae Sheet OCR (Tables 2).

TIME 1 hour

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the boxes above.

Answer **all** questions.

Write your answers, in blue or black ink, in the spaces provided on the question paper.

Read each question carefully and make sure you know what you have to do before starting your answer.

Show all your working out for calculations.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

Marks will be awarded for the use of correct conventions.

Dimensions are in millimetres unless stated otherwise.

Total marks for this paper is **50**.

Question Number	For Examiner's use only
1	
2	
3	
4	
5	
TOTAL	

Fig. 1 shows a skateboarder on a skateboard.

Fig. 1

1 Fig. 2 shows symbols or names of some components used in a pneumatically controlled skateboard factory.

(a) Complete Fig. 2 by drawing the missing symbols and adding the missing names.

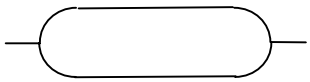
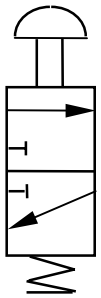
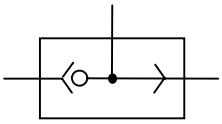
Component Name	Symbol	
A _____		**[1]**
B Main air supply		**[1]**
C Single acting spring return cylinder		**[2]**
D _____ _____ _____		**[2]**
E _____		**[2]**

Fig. 2

(b) Explain why component **E** in Fig. 2 is often used in pneumatics as an "OR" gate.

_____

_____

_____ **[2]**

2 The circuit shown in Fig. 3 was built to control a pneumatically operated printing press.

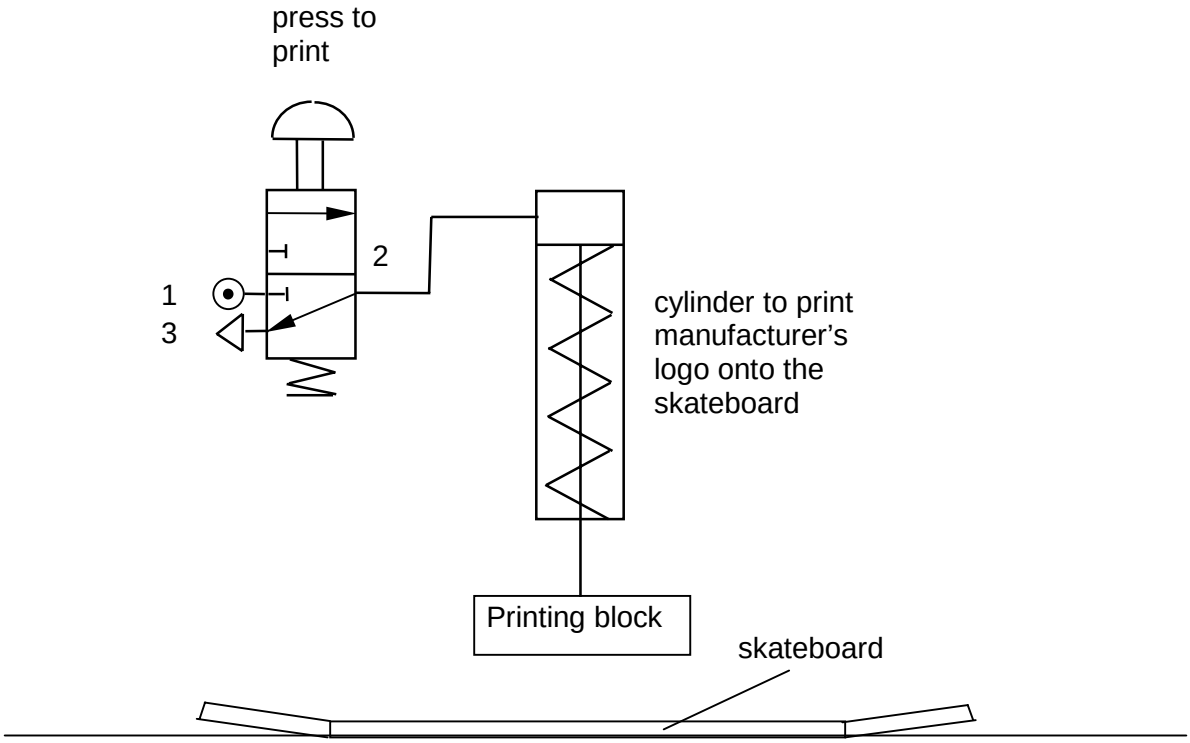


Fig. 3

(a) Explain what happens when the valve is pressed and held down.

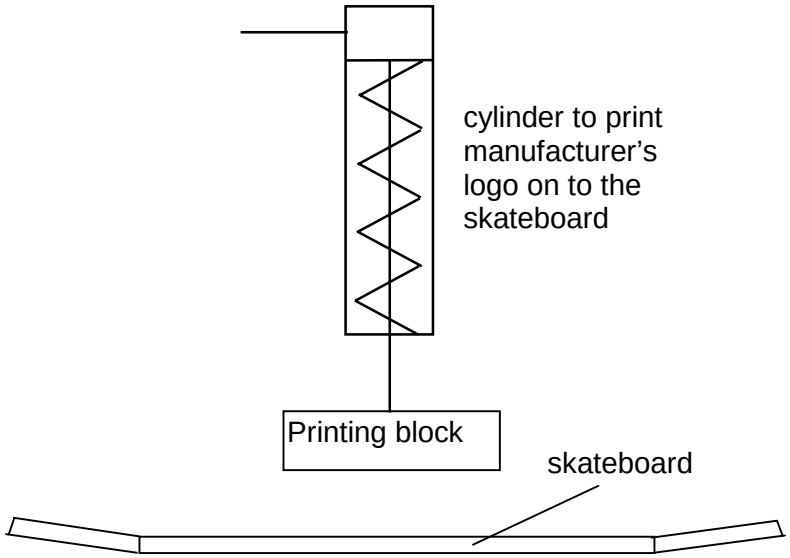
[3]

(b) Explain what happens when the valve is pressed for a few seconds and then released.

[4]

As a safety requirement the press had to be converted to a 2 handed machine to prevent the operator putting a hand under the press.

(c) Draw the arrangement of 2 push button operated valves linked in a way that makes the operator use both hands to print the logo.



[3]

3 Originally the printing process was done using a hand press as shown in Fig. 4.

(a) Give two advantages and two disadvantages of using the pneumatic system compared to the hand system.

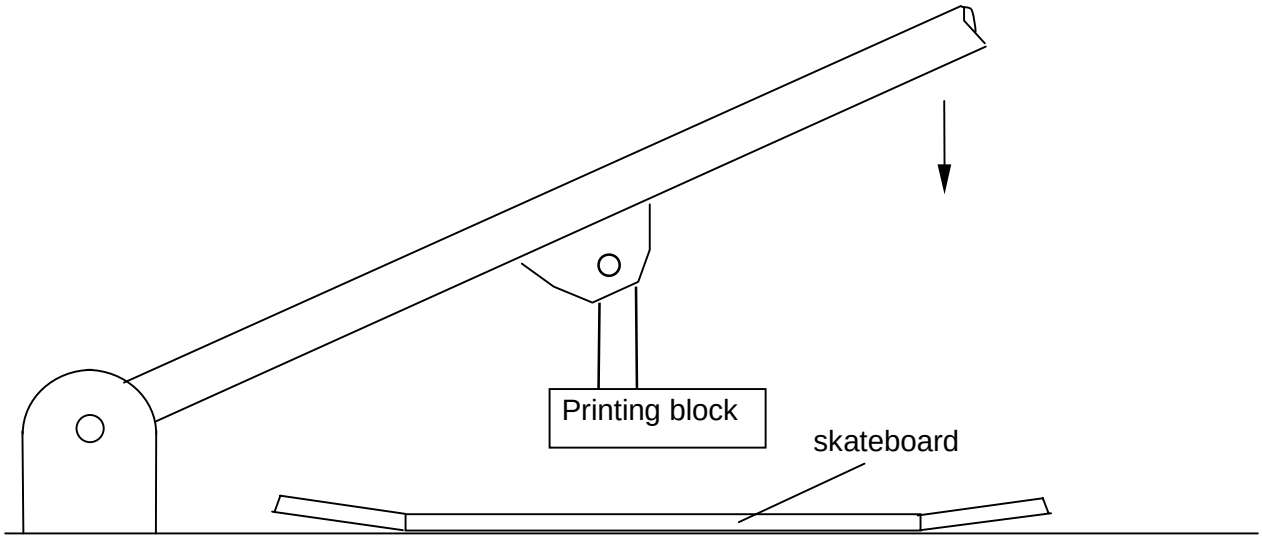


Fig. 4

Advantage 1 _____

_____ **[2]**

Advantage 2 _____

_____ **[2]**

Disadvantage 1 _____

_____ **[2]**

Disadvantage 2 _____

_____ **[2]**

(b) The cylinder on the pneumatic printer was hitting the skateboard so fast that the printing was being smudged.

Name the type of cylinder which could be used to prevent this.

_____ **[2]**

4 Computer Aided Machines (CAM) which manufacture the skateboard components are fitted with pneumatically powered sliding doors to protect the operator. This safety devices must ensure that the machine cannot be started unless the guards are in the closed position.

Fig. 5 shows a pair of sliding door guards on a Computer Numerically controlled (CNC) lathe.

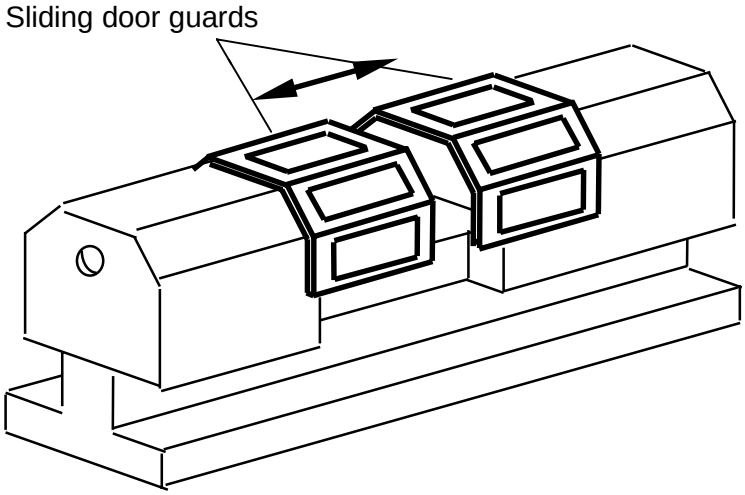


Fig.5

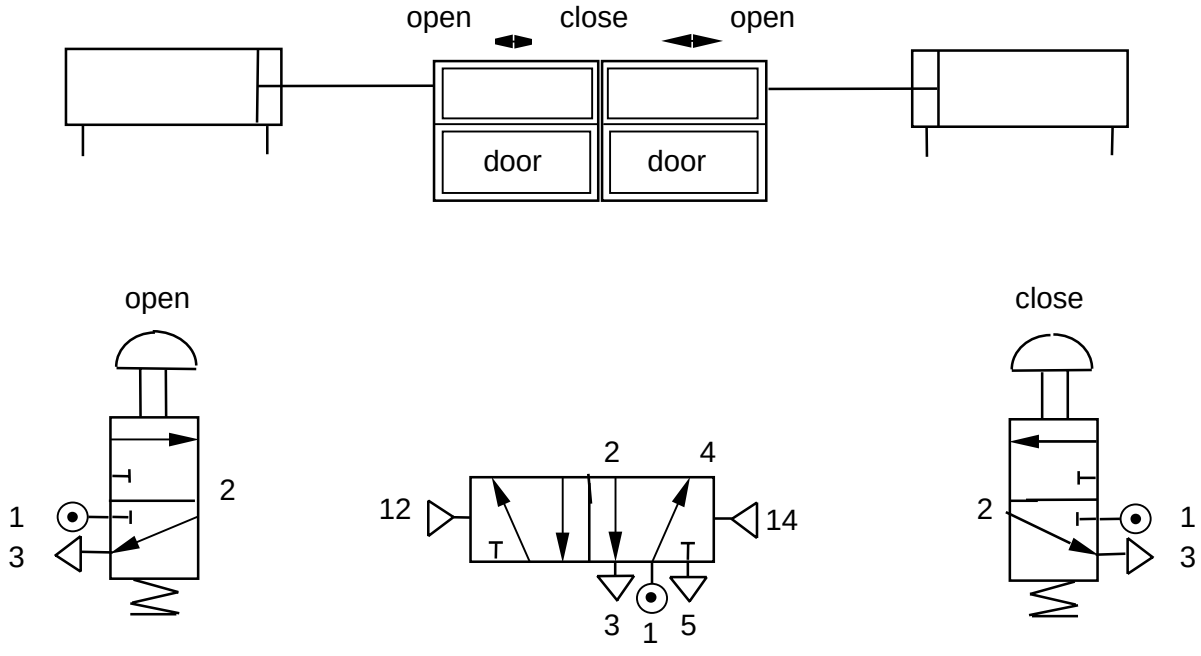


Fig. 6

(a) Using the correct type of air lines, complete Fig. 6 to show how the circuit is to be piped up so that the "open" button will open both doors and the "close" button close both doors. Use all the components shown. **[5]**

(b) The control board which monitors the CNC lathe must receive a signal which tells it that the doors are closed before the lathe can start.

One way to generate this signal could be by using a single acting spring return cylinder which is instroked by the action of the doors closing. The resulting pulse of air is converted into an electrical signal to the control board.

Fig. 7 shows a cylinder and part of the safety guards.

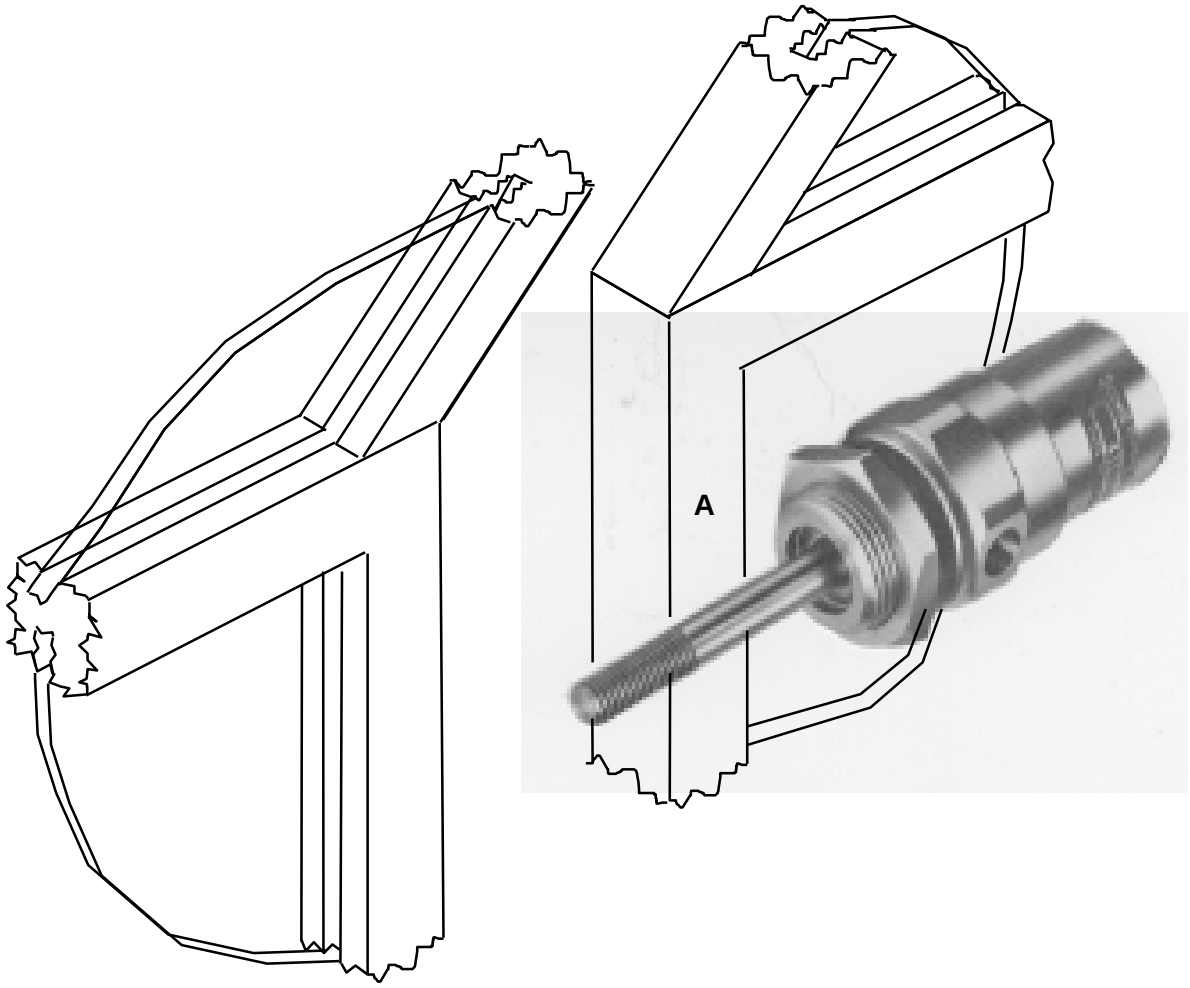


Fig. 7

Use sketches and notes on Fig. 7 to show a method of holding the cylinder body securely to the frame of the door guards at A. **[4]**

(c) CADCAM systems are widely used in the production of pneumatic components.

Give one reason for this.

_____

_____ **[1]**

5 Fig. 8 shows a special type of clevis attached to the threaded end of the piston rod.

This is used with a spigot fixed to the sliding door to operate the standard single acting cylinder.

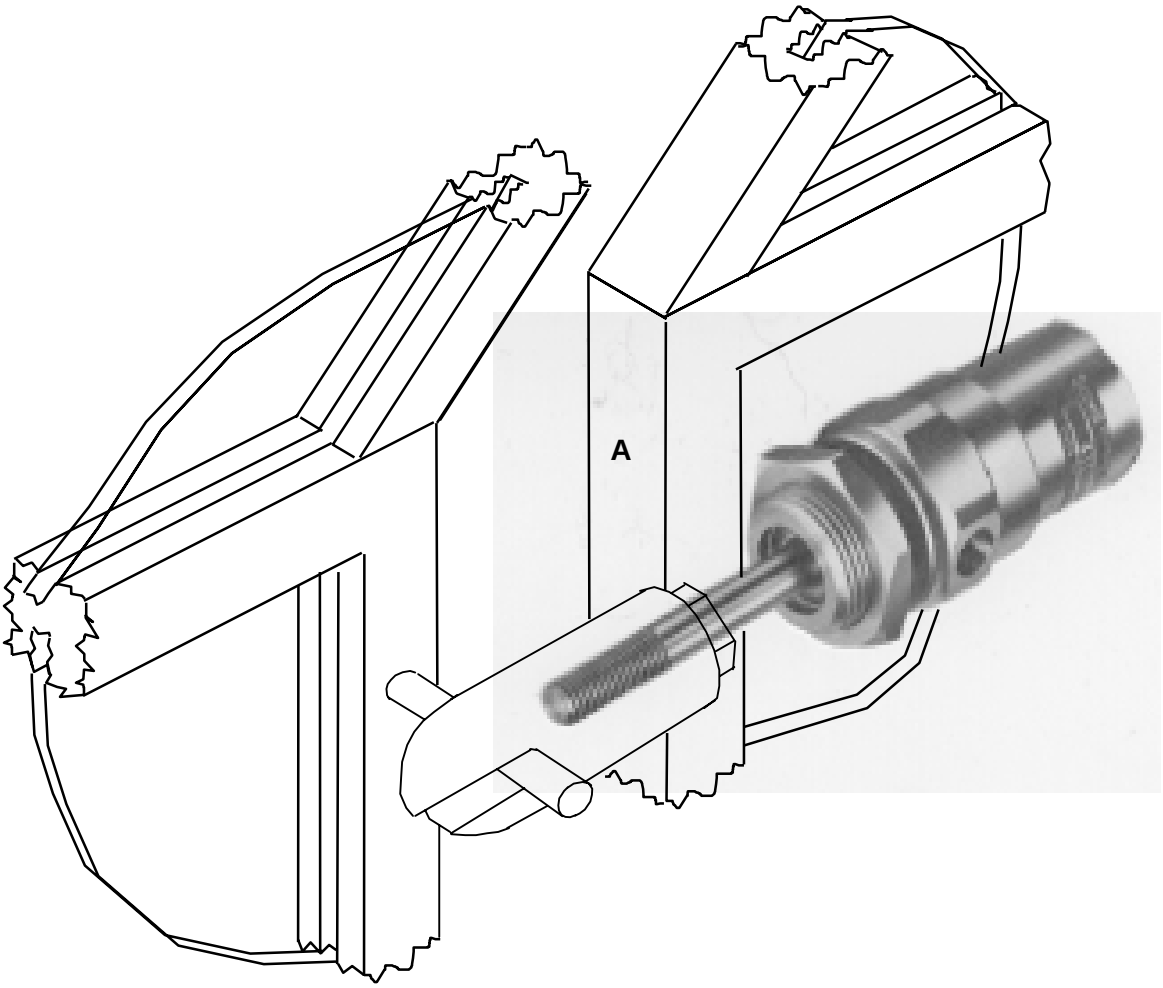


Fig.7

(a) Evaluate the effectiveness of this special clevis in this situation, when the doors are fully open the spigot and clevis are disengaged.

[6]

(b) Using annotated sketches show how the clevis arrangement can be redesigned to perform the function more reliably.

[4]

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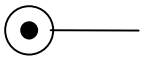
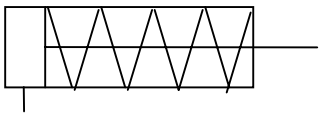
MARK SCHEME

Specimen Paper 2003

1 **(a)** A Reservoir **[1]**

B  **[1]**

C  **[2]**

D Push button **[1]**
spring return 3/2 valve **[1]**

E shuttle **[1]**
valve **[1]**

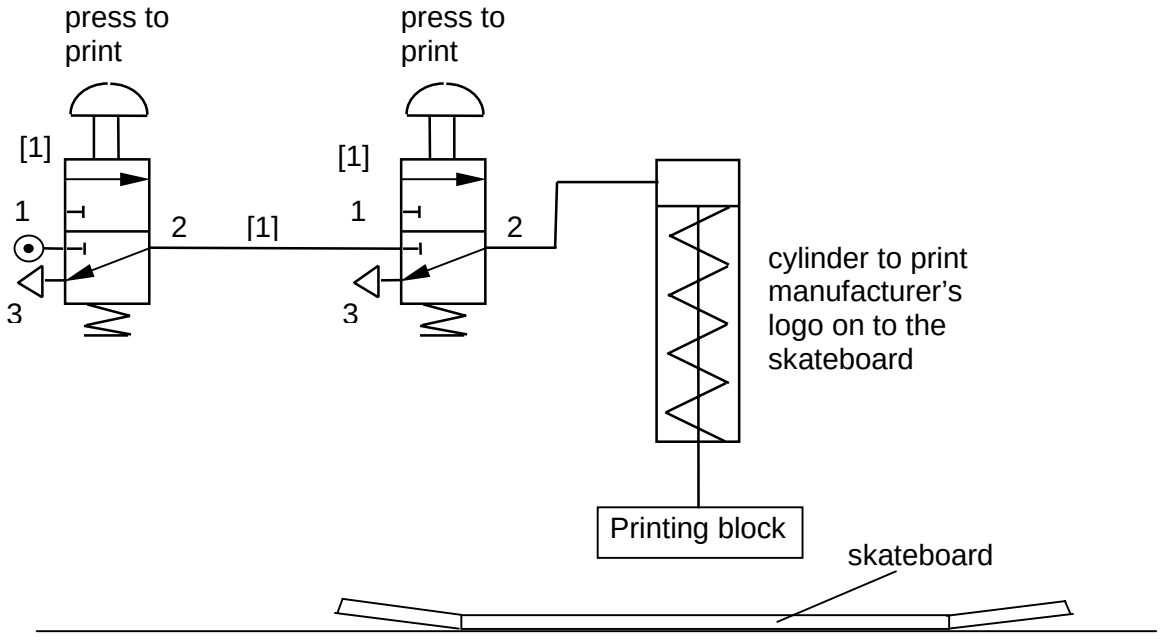
(b) Component E is used as an "OR" gate because a signal at one side or the other will give an output. **[1]** **[1]**

[Total: 10]

2 **(a)** When the valve is pressed and held down main air will pass from port 1 to port 2. **[1]**
The printing block will print on the skateboard. **[1]**
The block will stay in contact with the skateboard. **[1]**

(b) When the valve is pressed for a few seconds and then released main air will pass from port 1 to port 2. **[1]**
The printing block will print on the skateboard. **[1]**
The spring in the single acting cylinder will lift the block when the push button is released. **[1]**
To allow the air to exhaust. **[1]**

(c)



[3]

[Total: 10]

3 **(a)** Advantages

Each print should be identical.
Human strength not a factor.
More control over quality.
Could be easily automated.
2 marks for each answer max 4 marks **[4]**

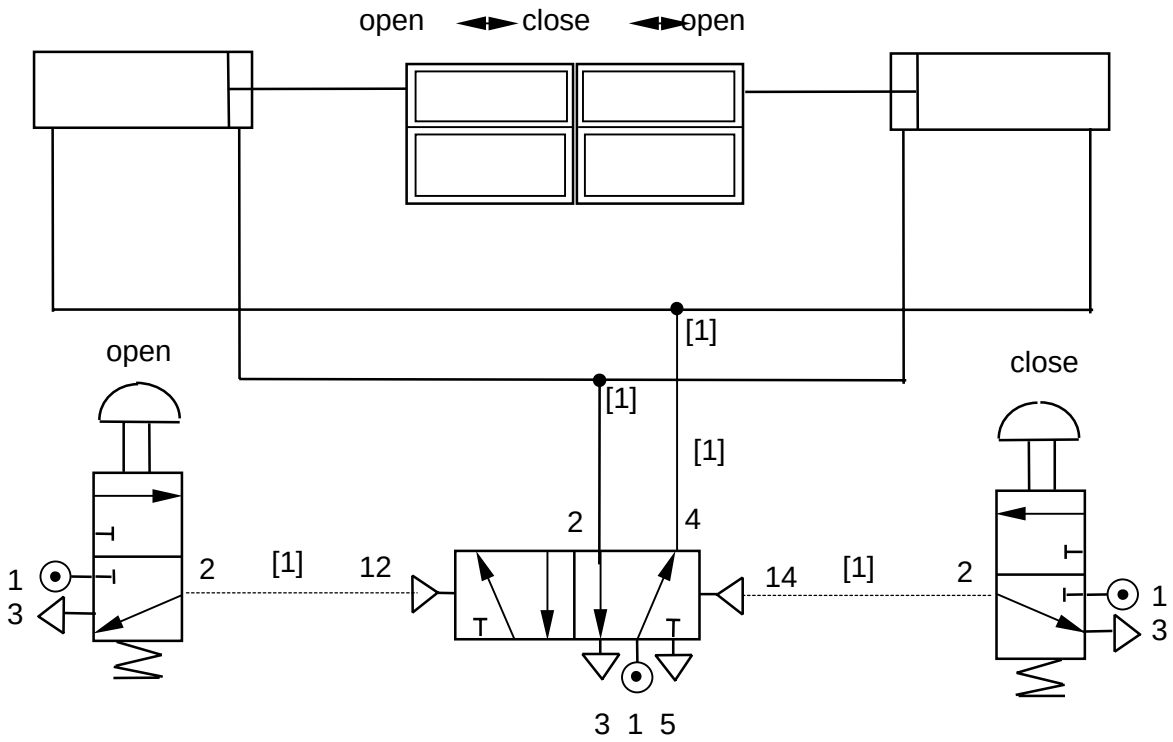
Disadvantages

Constant supply of air pressure needed.
Power cut can stop production.
More sophistication means more to break down.
More safety requirements to respect.
2 marks for each correct answer max 4 marks **[4]**

(b) A cushioned cylinder. **[2]**

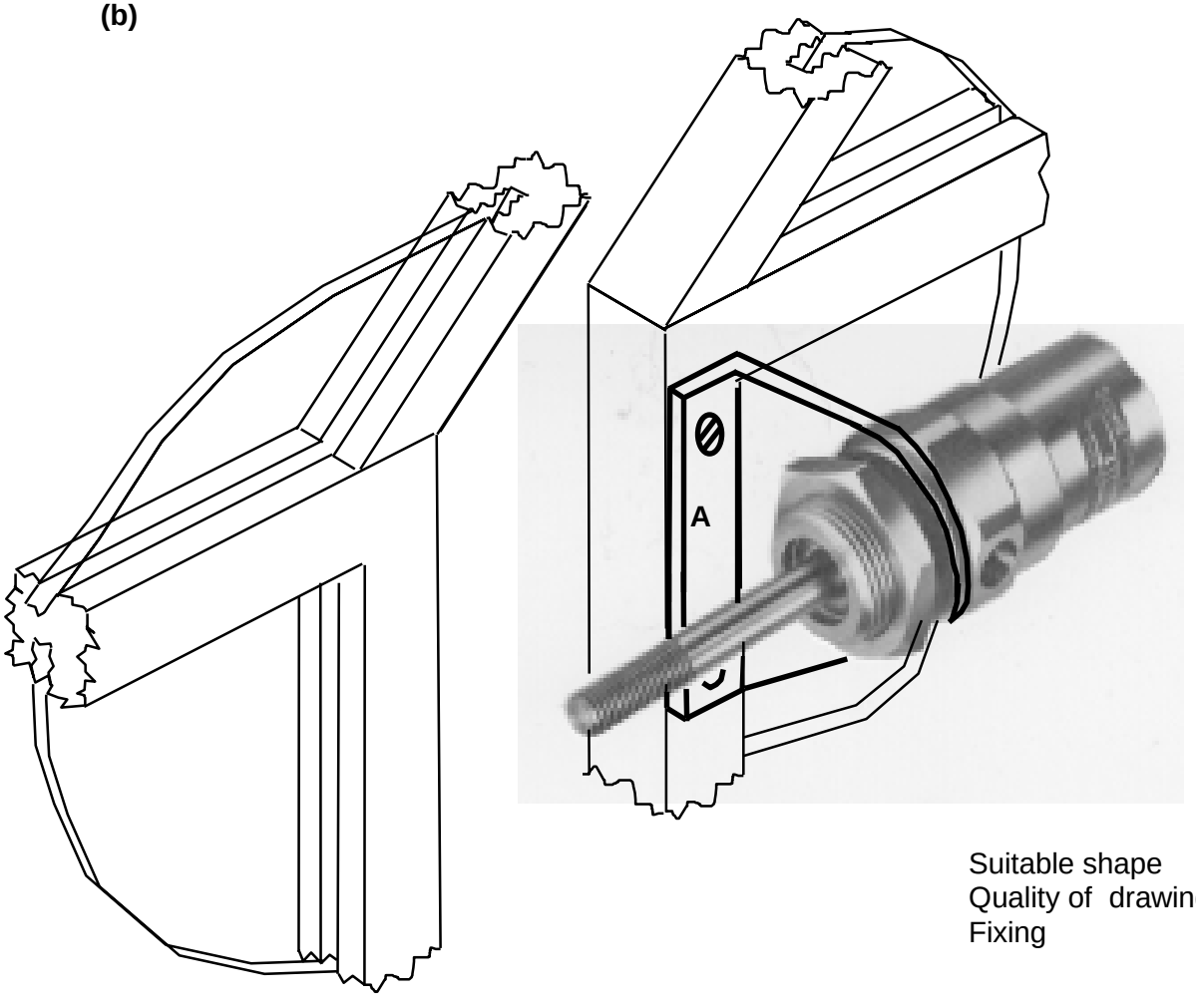
[Total: 10]

4 (a)



[5]

(b)



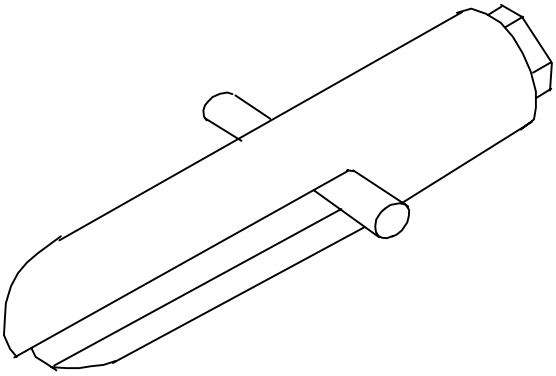
Suitable shape	**[2]**
Quality of drawing	**[1]**
Fixing	**[1]**

Fig.7

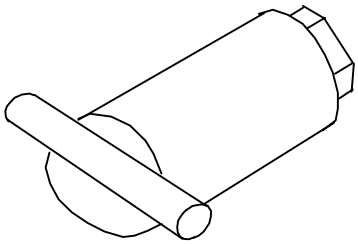
4 **(c)** CADCAM systems are widely used in the production of pneumatic components because they are made up of many smaller parts which are easy to mass produce on a CAM system. CAD systems are used to design the components. **[1]**

5 **(a)** The special clevis in this situation is not really suitable **[1]**
Because the piston rod in the cylinder can rotate. **[1]**
If this happens the clevis will also rotate. **[1]**
This will cause the clevis slot to miss the pin. **[1]**
If the clevis has rotated the pin will start to push the piston rod in too soon. **[1]**
This would be dangerous. **[1]**

(b) Possible answers:



Make the clevis longer so that the pin never leaves the slot.



Make the end of the clevis flat so that the pin will always find the same position.

Idea **[2]**
Quality of sketch **[2]**
[Total: 10]

Total mark available: 50

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