THIS IS A NEW SPECIFICATION

OCR
RECOGNISING ACHIEVEMENT

GENERAL CERTIFICATE OF SECONDARY EDUCATION

DESIGN AND TECHNOLOGY

A514/02

ELECTRONICS AND CONTROL SYSTEMS

Technical aspects of designing and making
Pneumatics

OCE/11637

Candidates answer on the Question Paper

OCR Supplied Materials:
None

Other Materials Required:
- A calculator may be used

Tuesday 26 January 2010
Morning

Duration: 1 hour 15 minutes

A514 02

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.
- 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.
- The total number of marks for this paper is **60**.
- Marks will be awarded for the use of correct conventions.
- Your Quality of Written Communication is assessed in questions marked with an asterisk (*).
- Dimensions are in millimetres unless stated otherwise.
- This document consists of **12** pages. Any blank pages are indicated.

A calculator may be used for this paper

Section A

Answer **all** questions.

1 Fig. 1 shows the rear view of a pneumatically controlled puppet.

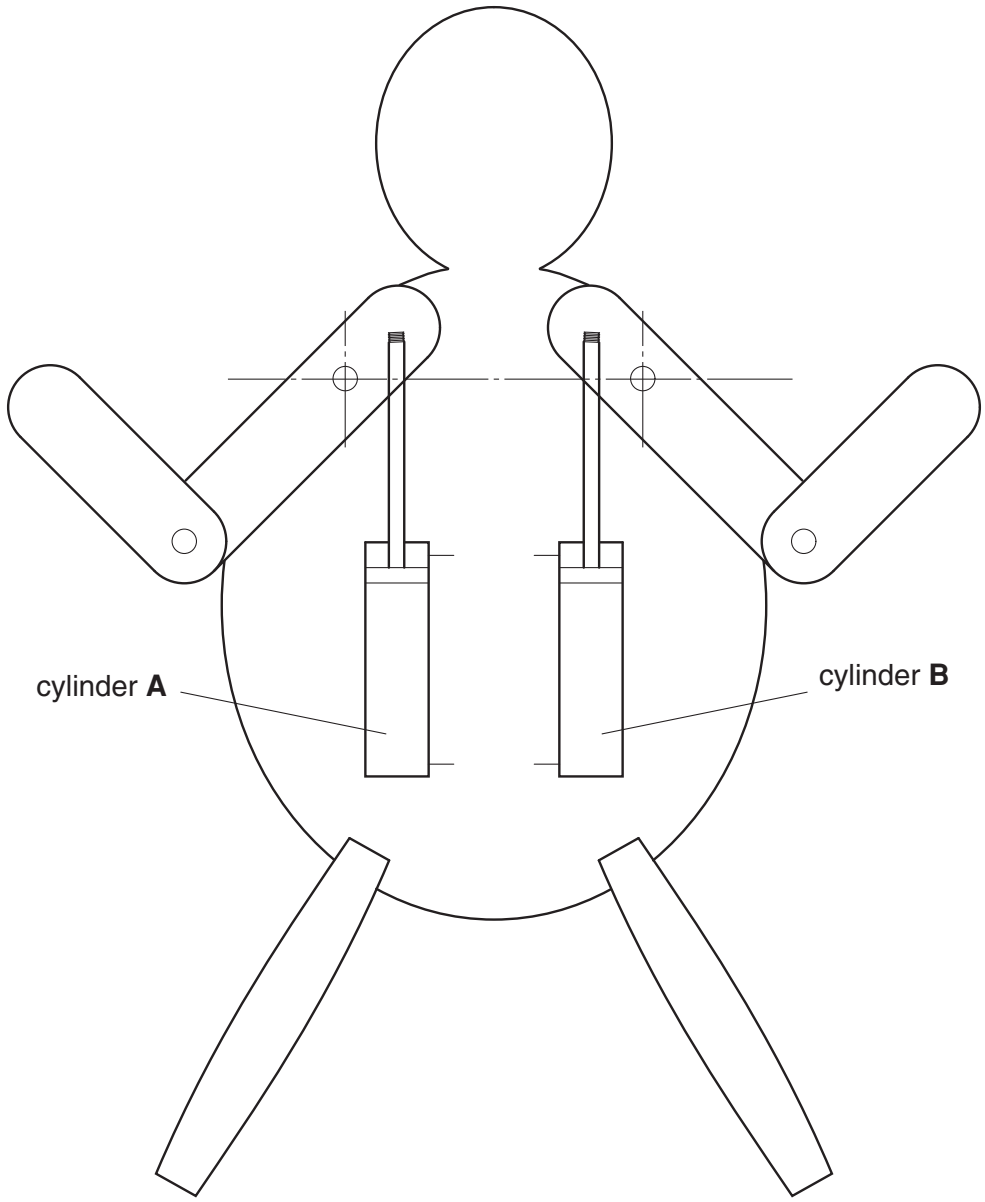
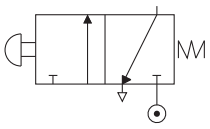
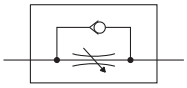


Fig. 1

(a) The table below shows the name and symbol for components in the pneumatically controlled puppet.

Complete the table by drawing in the missing symbols and adding the missing names.

The first one has been done for you.

component name	component symbol
A exhaust	
B ……	
C ……	
……	
D shuttle valve	
E single acting cylinder	
F ……	

[1]

[2]

[2]

[2]

[2]

(b) Explain how the single acting cylinder part E in the table above differs from a double acting cylinder.

.....

.....

.....

..... **[3]**

[Total: 12]

2 Fig. 2 shows the components for the circuit to raise the arms of the puppet and then lower them.

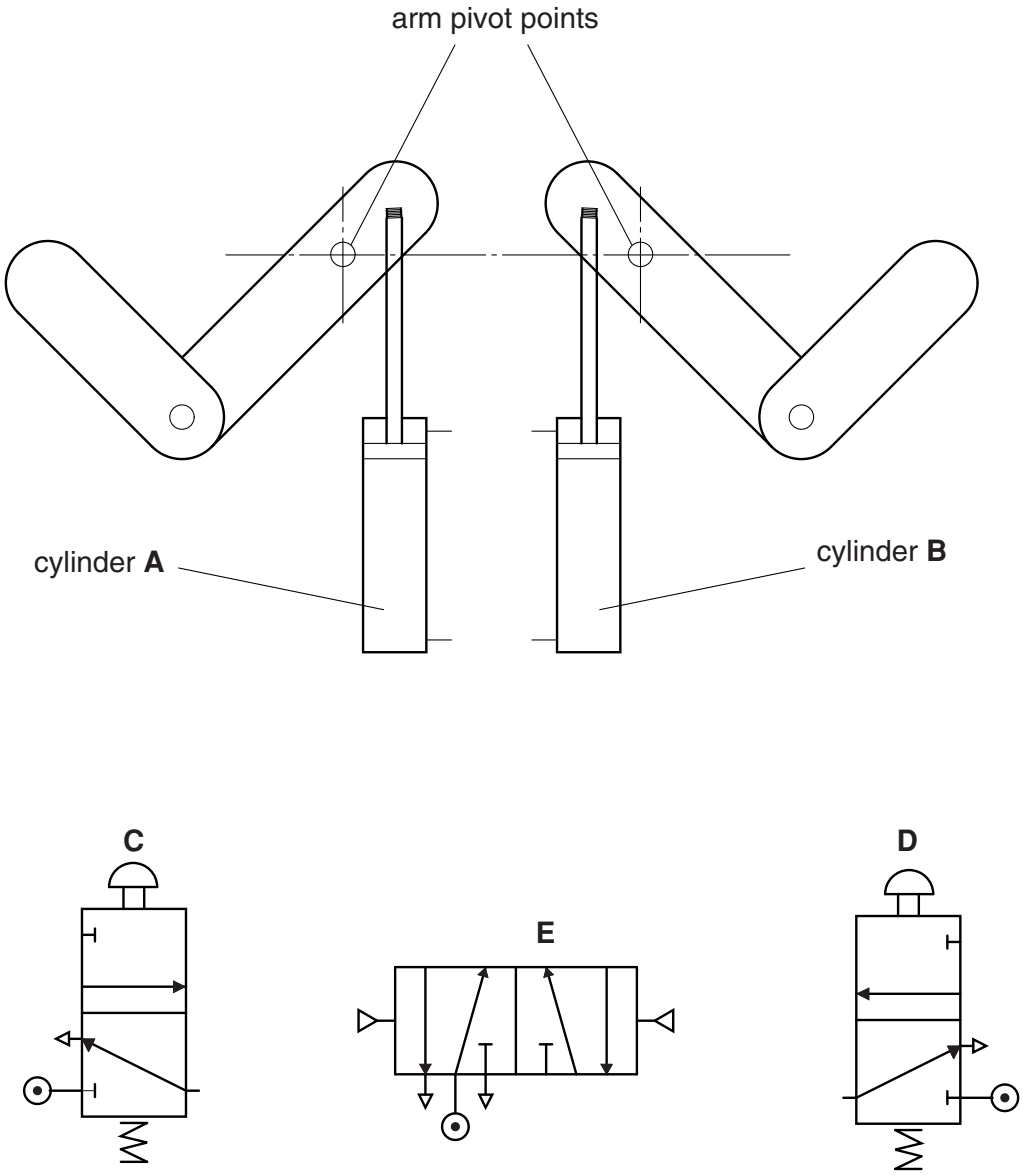


Fig. 2

(a) Complete the circuit in Fig. 2 which will make both cylinders A and B raise the arms (instroke) when valve C is pressed and released, and lower the arms (outstroke) when valve D is pressed and released. **[6]**

(b) Explain how the circuit in Fig. 2 operates, making reference to valve E.

.....

.....

.....

.....

.....

.....

.....

.....

..... **[4]**

(c) Explain the reason for the springs as shown on the bottom of valves C and D.

.....

.....

.....

..... **[2]**

[Total: 12]

3 A computer could be used to switch valves **C** and **D** ON and OFF as required and also to operate cylinders **A** and **B** in Fig. 2.

(a) Fig. 3 shows valve C from the existing circuit in Fig. 2.

In the space next to Fig. 3 draw a similar valve which can be controlled directly from the output of the computer.

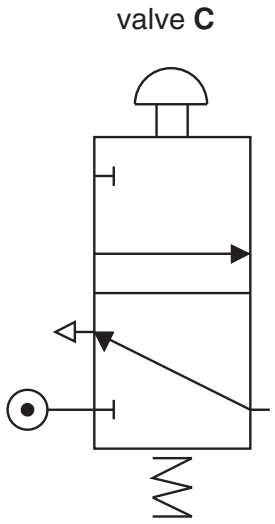


Fig. 3 **[2]**

(b) Fig. 4 shows cylinder **A** from the existing circuit in Fig. 2.

In the space next to Fig. 4 draw another type of cylinder which can send a signal directly to the input of the computer to indicate reaching each end of the piston stroke.
Add notes to explain the difference.

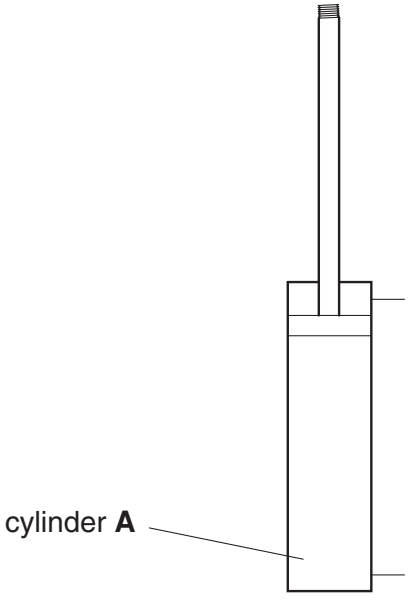


Fig. 4 **[4]**

(c)* Closed loop systems use some form of feedback.

Discuss the feedback which can be found in various types of pneumatic system.

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

.... **[6]**

[Total: 12]

Section B

Answer **all** questions.

4 Fig. 5 shows the mechanism to control one of the arms from Fig. 2.

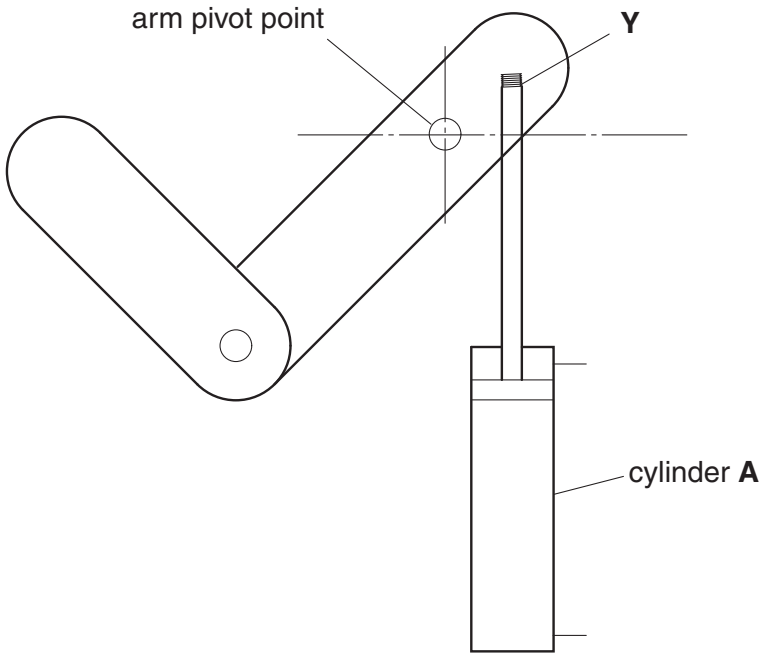


Fig. 5

(a) On Fig. 6 draw a design for an attachment that will fit the threaded end of the piston rod to the arm at **Y** and:

- make the arm move freely with the instroking and outstroking movement of the cylinder;
- prevent the attachment from becoming loose from the piston rod and the arm.

Add notes where necessary.

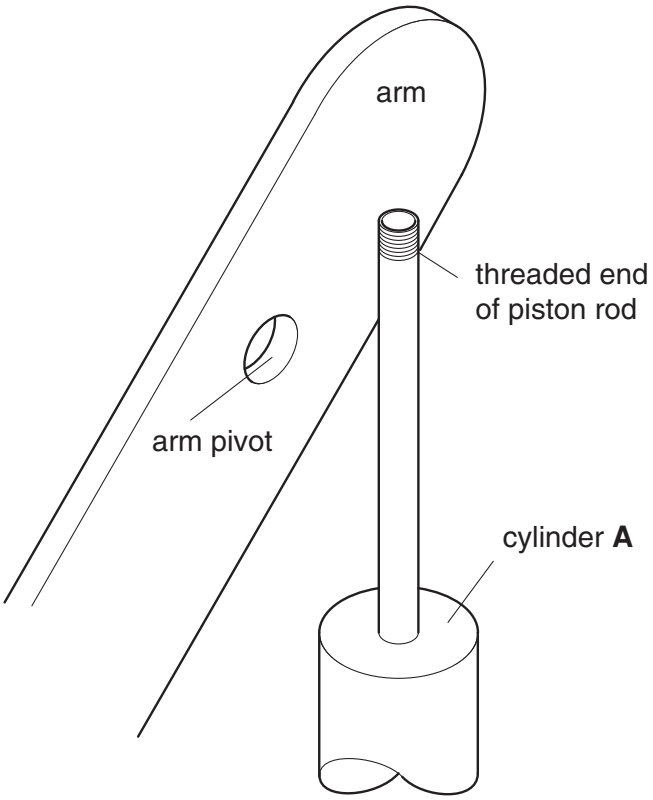


Fig. 6 **[6]**

(b)* In industrial pneumatic applications the air supply to the circuit is produced by a compressor and sent to a reservoir or receiver.

The compressed air is then distributed around a circuit.

Discuss the safety requirements that must be put in place when producing and distributing compressed air.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**

[Total: 12]

5 Fig. 7 shows an alternative circuit which will allow children to cover the air bleed at **X** and make the arms go up and down.

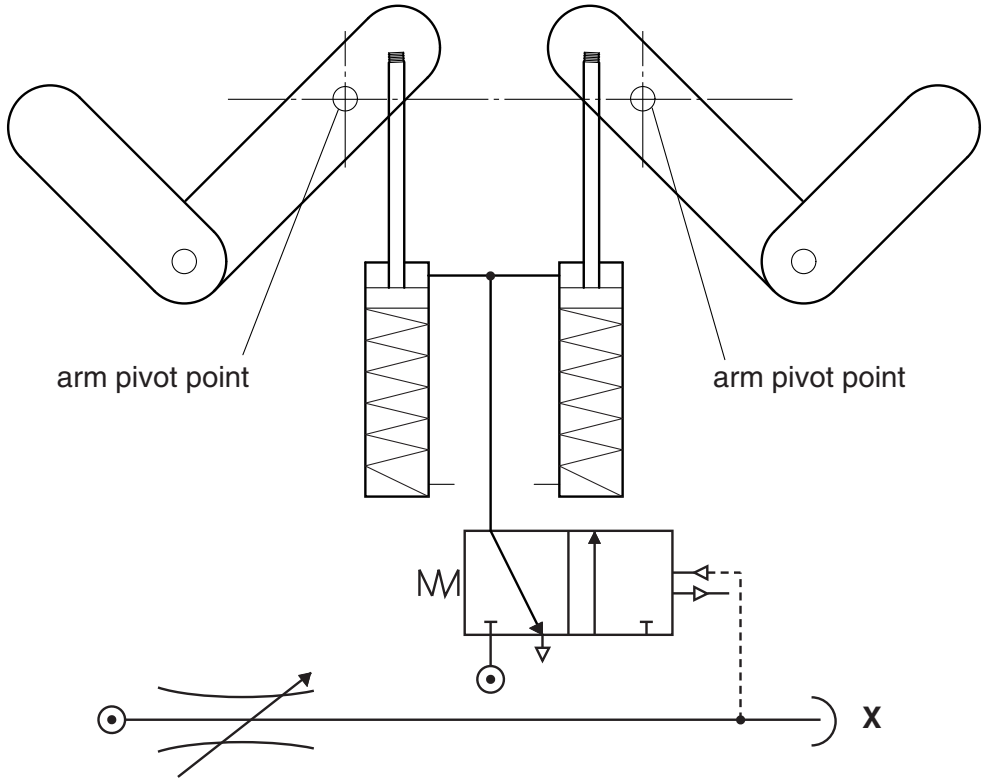


Fig. 7

(a) The air bleed circuit in Fig. 7 will operate when the air bleed at **X** is covered and then uncovered.

Put the letter describing the steps in the correct order in the boxes.

The first step has been completed.

(A) This sends main air to the 2 cylinders.

(B) When the air bleed is covered at **X** low pressure air is diverted to the 3/2 diaphragm valve.

(C) The low pressure is sufficient to change the state of the diaphragm valve.

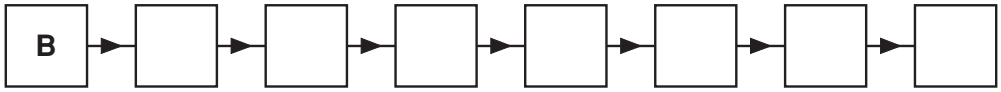
(D) Main air is cut to the cylinders.

(E) The cylinders outstroke and the arms drop down.

(F) When the air bleed is uncovered the diaphragm valve relaxes.

(G) The spring in the single acting cylinders take over.

(H) This air instrokes the cylinder which raise the arms.



[7]

(b) The cylinders in Fig. 7 each have a diameter of 20 mm with a piston rod diameter of 4 mm. The force required by each cylinder to lift the arm is 20 N.

Calculate the minimum air pressure required to raise one arm as the cylinder **instrokes**.

Use the formula $F = P \times A$.

.....

.....

.....

.....

.....

..... **[5]**

[Total: 12]