Design and Fabrication of Hydraulic Punch Shear

Project Work 1991-92

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Date : 17.3.1992.

This is to certify that the following final year students of **Kumaraguru College of Technology** successfully carried our their project in our industry titled **Hydraulic Punch shear.**

S. KRISHNA KUMAR

K. MUTHUVEL

R. NANDA KUMAR

They had shown keen interest in designing and fabricating the machine. We wish them all success in future career.

For Coimbatore Machines & Toolings,

Proprietor.

K. GANESAN,

(Proprietor).

ACKNOWLEDGEMENT

At the outset we acknowledge kindness and generosity of **Major T.S. RAMAMURTHY, B.E.,** for allowing us to take this project. As in the mainspring to the clock so is the Principal to our institution. Our deep felt gratitude are due to him.

We place on record our hearty thanks to **Mr.K.KANDASWAMY B.E., M.Sc., (Engg)** Assistant Professor of the department of Mechanical Engineering for his constructive criticism and constant encouragement.

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We are deeply thankful to **Mr.GANESAN,** Proprietor of Coimbatore Machines & Toolings for sponsoring our project and his guidance without which this book would not have seen the light of the day.

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Last but not the least, we thank our department staffs and fellow friends for their fullest help as our adviisors.

S Y N O P S I S

This project deals with the design and fabrication of Hydraulic punch shear. This is designed for the requirement of both punching and shearing. This is a special purpose machine. The total design of the machine has been clearly brough out in this book.

Whenever we go in for any special purpose machine in the market the cost of the machine will be higher. So it has been decided to design and fabricate a machine which is very much cheaper and specific on purpose.

The project also deals with both power operated and manually operated pumps which elaborates the design and all the required drawings are presented.

Some of the conclusions of the whole exercise are also presented in this report.

CONTENTS

1. INTRODUCTION
2. WORKING PRINCIPLE
3. DESCRIPTION OF VARIOUS PARTS
4. DESIGN AND FABRICATION
5. SPECIFICATION OF THE MACHINE
6. COST ESTIMATION
7. BIBLIOGRAPHY
8. CONCLUSION
9. DRAWINGS
10. PHOTOS

INTRODUCTION

We are well aware that industrial hydraulics technology is firmly entrenched in our global economy. The usage knows no boundary lines. So it has been decided to do the project in hydraulics.

The highlights of the project is elaborated in the following passages. The ultimate aim of this project is to reduce the cost of the machine which is a difficult task. Any machine available in the market for a specified work costs more. The small scale industrialists whose investment is limited to a circle cannot afford this much.

This machine is meant for special purpose of shearing and punching of the job which has a limited cross sectional area of 1500 mm^2. It can be understood the machine is applicable for multipurpose.

Hydraulics is the science of transmitting and controlling energy through the medium of pressurised oil which has several advantages over other methods of energy control. Thereby it has been decided to do the project using hydraulic systems.

The intensifier principle is applied to design the machine. With the limited pressure available at the output of the pump enormous force is developed. The pressure is boosted upto 4 times in the design and a force of around 50 tons is developed at the output of the cylinder.

The speciality of our project is that the machine can be operated eventhough there is no power. A hand operated pump is designed to the required value of pressure which needs just some more time to develop the pressure.

In our country it is the trend to get the ready made machines and utilise for the purpose. In foreign countries like Germany and England the industrialists are making use of plunger pumps for special purpose machine. Likewise it has been decided to design a pump which has low pressure output from which the required force is developed.

Also a power pack which has 1 HP motor to operate the pump is purchased in the market. This pump is made use of whenever low force is required for a specific purpose. In this case, the power required to operate the machine is very low, as just 1 HP motor is needed to be run. Thereby the power requirement is very very less when it is compared with the industrial power requirements.

It is dealt in detail the design procedure and fabrication of the machine. To understand fully about the machine it is clearly presented with all part drawings, sub assembly and assembly drawings in this book.

WORKING PRINCIPLE

To begin with the project report the principle under which the machine operates is elaborated here.

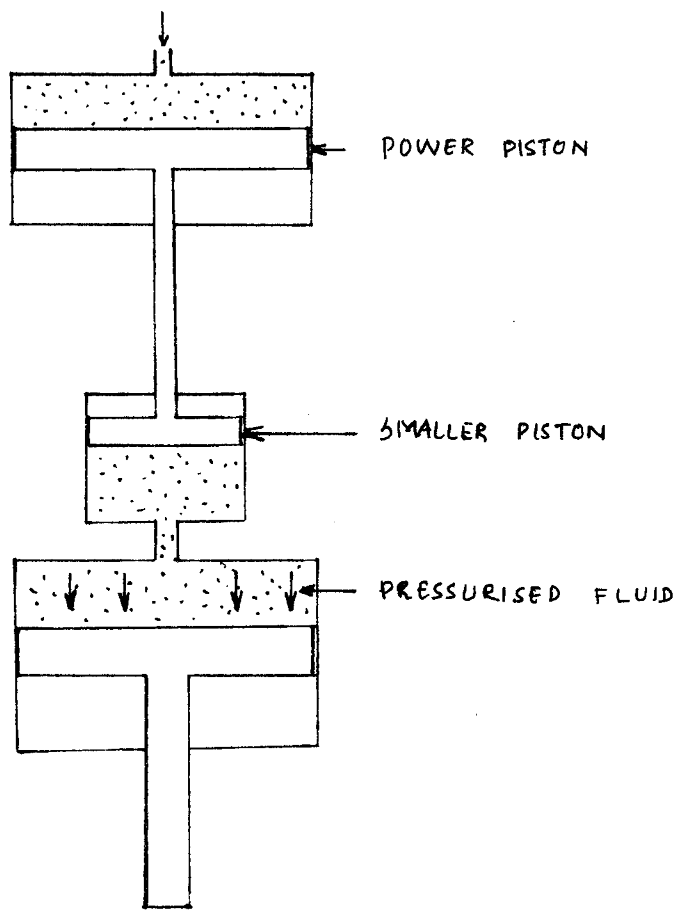
All fluid-power systems follow natural and predictable laws. Pascal first developed the law underlying the operation of all modern hydraulic devices. Pascal's law states that, "Pressure applied anywhere to a body of confirmed fluid is transmitted undiminished to every portion of the surface of the containing vessel."

When a force is applied to the fluid by a piston or other similar device, the fluid transmits this force equally to all surfaces. In a hydraulic system the pressure can be developed from force and vice versa.

It is desired from a relatively small volume of fluid at a pressure value appreciably higher than that required in the remainder of the systems. If the pump used is a fixed displacement unit or is limited in its pressure capacity, it may not be possible or practical for the designer to obtain the required pressure increase within the existing parameters and components.

Here at this critical moment only the intensifier or booster permits the designer to utilize existing volume by converting it to pressure, and thereby to attain a pressure value far in excess of the limits established by the pump-motor combination.

INTENSIFIER PRINCIPLE:



The maximum pressure value of the fluid is increased above the system pressure by the ratio of piston areas in the intensifier. As the power piston of the intensifier advances, fluid is displaced by the smaller piston in the high pressure chamber.

For example a 100mm piston an effective area of 78.54 cm^2 might be working against a smaller piston of approximately 4.91cm^2 area. This ratio means that the system pressure would be increased to twelve times its initial value in the intensified portion of the circuit.

As explained above the intensifier principle can be adopted to boost up the pressure. The pump has a low pressure output which is entered into the cylinder. In the cylinder the pressure of the liquid (or) oil is boosted up to several times and the force is also increased correspondingly as the pressure is increased.

The pump design is based on the piston pumps category. Piston pumps are extremely efficient, with volumetric efficiencies in some fixed delivery pumps as high as 99%. Among all hydraulic pumps piston pumps offer the greatest power density maximum power for minimum size and weight. Thereby plunger pump which comes under the category is selected and design is carried out.

PUNCHING AND SHEARING:

Punching:

The formation of hole is the desired result while punching. It is the operation of production of hole in a sheet metal by the punch and die. The material punched out of form the hole constitute the waste. The size of the hole is determined by the size of the punch and the clearance is allowed on the die.

Shearing:

The shearing operation can be explained in following way. As the punch descends upon the workpiece, the pressure exerted by the punch causes the metal to be deformed in the die. As the clearance between the punch and the die is very small the plastic deformation takes place in a localised area and the metal adjacent to the cutting edges of the punch and the die becomes highly stressed. When the stress reaches beyond the ultimate strength of the material, the fracture starts from both the sides of the plate along the cutting edges of both die and the punch and as the punch continues to descend the fracture meet at the centre of the plate. The metal is now completely severed from sheet metal and drops out through the die opening.

DESCRIPTION OF VARIOUS PARTS

Once the basic parts are mastered, any assembly can be devised using combinations of these parts. Therefore various parts of the machine is dealt in detail in this chapter.

PARTS OF HYDRAULIC CYLINDER:

Cylinder and piston:

A hydraulic cylinder itself is a part and is described as a linear actuator in where the operating fluid is a liquid. The favoured material for hydraulic cylinder tubes is cold drawn tubing. The majority of such tubes are drawn from low carbon mild steel with nominal composition of non-ferrous materials.

Choice of material for piston is generally limited to cast iron of steel. For light duty cylinders pistons are located by circlips.

Sealings:

Basically a seal is a device for closing gap or making a joint fluid tight although it may be called upon to perform other functions as well according to the applications. Sealings are required both at rod end cover and at piston. Neoprene-rubber is extensively used in this project work.

O-ring: The O-ring is the most versatile or all seals with the particular advantages of simplicity and low cost. Basically an O-ring seal comprises an O-ring ripped in a cavity in which the ring is replaced. O-rings are normally moulded in rubber like materials.

Pressure control valves:

These valves are used in hydraulic systems to control and maintain fluid pressure at diffierent level in various parts of hydraulic circuits.

Relief valve:

A relief valve limits the maximum pressure that can be allowed in that portion of hydraulic circuit to which it is connected. Relief valve provides an alternative path to tank for the system of oil while keeping the maximum pressure constant. To achieve this these are located on the pressure lines.

Spring loadـs valves:

Spring loaded valves are used wherever the pressure exceeding a limit is to be reduced. The spring loaded valve opens if the inlet pressure is greater than the outlet pressure plus ths spring pressure. Otherwise, the ball closed the port due to spring tension.

Reducing valves:

In contrast to the normally closed pressure control valves a reducing valve is normally open and blocks. It modulates flow at present pressure.

Filters:

A hydraulic filter is a device whose primary functions is the retention by porous media of insoluable contaminants from a liquid. Properly matched to a hydraulic system, a filter not only serves as insurance, but also can significantly reduce downtime.

Suction and pipe connections:

To prevent frothing of the fluid the return lines should be installed within two pipe diameter of the bottom of the tank. The velocity of the return fluid should also be reduced inorderto prevent the sediments in the tank from being stirred. Return and motion lines are separated so that fluid will travel the greatest possible distance in the reservoir for best heat transfer to the walls.

Hydraulic power pack:

The term power pack as applied to the hydraulic industry covers a multiplicity of pressure generators. The popularity of usage of hydraulic power pack is based on two factors: The relative ease of installation by the purchaser and the consequent saving on skilled labour in site and overall time reduction in commissioning often more than compensate for any extra costs involved over and above the cost of obtaining component parts.

DESIGN AND FABRICATION OF HYDRAULIC CYLINDER:

Hydraulic power systems are widely used now a days. Cylinder is heart of the machine. Hydraulic cylinder is designed to achieve the required value of pressure. Different effective areas are used to intensify the pressure. The energy transmission is taken care by the hydraulic fluid. It is assumed that the fluid used is incompressible. All hydraulic fluids are compressible slightly if sufficient pressure is applied to this liquid.

The cylinder design is based on the force required to carry out the work. The pressure is boosted up by adopting the intensifier principle.

Initially the valves of the cylinder inner diameter is assumed and the calculations are carried and suitable diameter is selected. The output of the pump is 100kg/cm². This pressure is intenified to a pressure of 400kg/cm². The area is reduced to half the area of the master cylinder which results in boosting up the pressure into 4 times.

The cylinder is carefully designed so that there is no chance for failure. The pressure is increased to 400 kgf/cm². The cylinder walls are to withstand this high pressure. To achieve the safe conditions the wall thickness is calculated by referring into the books.

To be on the safer side increased wall thickness is applied and the cylinder is fabricated to that condition. For our convenience and good appearance of the cylinder the height is reduced by machining the slave pistons which avoids the unnecessarily wasted volume of the cylinder.

To design the cylinder the main consideration of the stresses are shear stress and yield stress of the material. The following passages elaborately explains the details and procedure of hydraulic cylinder design.

<u>Required force calculation:</u>

Shearing area of the work piece $A = 1500 mm^2$

Yield stress $f_y = 400\ N/mm^2$

To find shear stress $f_s = 0.6 \times f_y$

$= 0.6 \times 400$

$= 240\ N/mm^2$

To find shear force $F_s = f_s \times A_s$

$$= 360000\ N$$

$$= \frac{360000}{9.81}\ kgf$$

$$= 36697.2\ kgf$$

$$= 36.697\ tons$$

$$F_s = \underline{37\ Tons}$$

Max force needed $F_s = \underline{40\ Tons}$

This force of 40 tons is applied in the hydraulic cylinder by boosting up the pressure. The pressure is boosted up by applying the intensifier principle. The ultimate aim of the project is to achieve the maximum force from the minimum available pressure which in turn forces us to apply the intensifier principle.

It is fixed that an initial pressure of 100 kg/cm^2 is available at the output of the pump.

We need a force of 50 tons at the output of the hydraulic cylinder. The following is the design procedure which elaborately describes the achievement.

Force developed in the cylinder:

Force developed in the master cylinder is obtained as followed

To calculate the force

$$F = P \times A$$

$$= 100 \times \frac{¶ \times 12^2}{4}$$

$$= \underline{11309.7 \text{ kgf}}$$

In the intensifier to boost up the pressure it is assumed that the slave piston would have half the diameter of the master piston,

Thereby:

Pressure at the slave cylinder

$$P = \frac{F}{A}$$

$$= \frac{11309.7}{\frac{¶}{4} \times 36}$$

$$P = 399.99 \text{ kgf/cm}^2$$

$$= \underline{400 \text{ kgf/cm}^2}$$

Therefore for this pressure the force available is

$$F = P \times A = 400 \times \frac{¶}{4} \times 144 = 45238 \text{ kgf}$$

Since the standard size available in the market is only of 127 mm bore seamless tube to fabricate the cylinder the designed values are considerably changed.

$$\text{Force at master cylinder } F = \frac{100 \times ¶ \times 12.7^2}{4}$$

$$\text{Pressure at slave cylinder} = 12667.7 \text{ kgf}$$

$$P = \frac{F}{A}$$

$$P = \frac{12667}{\frac{¶}{4} (6.3)^2}$$

$$\underline{P = 406.38 \text{ kgf/cm}^2}$$

Therefore force at the output

$$F = P \times A$$

$$= 406.38 \times \frac{¶}{4} (12.7)^2$$

$$F = 51478.95 \text{ kgf}$$

$$F = 51.5 \text{ tons}$$

$$F = 50 \text{ tons}$$

Thickness calculation:

To find the required thickness of the cylinder

Diameter of the cylinder	D	=	127mm
stress	F	=	450 N/mm^2
pressure	P	=	400 kgf/cm^2
		=	39.24 N/mm^2

Let the radial pressure and loop stress at any radius 'r' is given by

$$P_x = \frac{b}{r^2} - a$$

$$39.24 = \frac{b}{63^2} - a \quad - (1)$$

$$P_x = \frac{b}{r^2} + a$$

$$450 = \frac{b}{63^2} + a \quad - (2)$$

$$1786050 = b + 3969 \quad a \quad - (1)$$

$$155743.56 = b - 3969 \quad a \quad - (2)$$

$$2b = 1941793.6$$

$$b = 970896.8$$

$$a = 205.38$$

WE know that $X = r_1,\quad P_x = 0$

$$0 = \frac{b}{r_1^2} - a$$

$$r_1^2 = \frac{b}{a} = 4727.32$$

$$r_1 = 68.76mm$$

$$t = 68.76 - 63$$

$$t = \underline{5.76mm}$$

Requried thickness $t = 5.76mm$

To check for shear strength

$$\text{stress} = 60\ kg/mm^2$$

$$\text{shear area} = \pi Dt$$

$$\text{force} = 50000\ kgf$$

$$\frac{50000}{\pi Dt} = 60$$

$$t = \frac{50000}{60 \times \pi \times 127}$$

$$= 2.089mm$$

$$t = 2.1mm$$

Required thickness $= \underline{2.1mm}$

Hence, from the calculations it has been decided that the maximum required thickness is 6mm only. But the cylinder to suit for further applications ie., to apply the high pressures the optimum value of about 15mm thickness is selected and the final size of the cylinder would be :

Inner diameter of cylinder	D_1	=	127mm
Outer diameter of cylinder	D_2	=	160mm
Size of the Master piston		=	127mm
Size of slave piston		=	63mm

Apart from all these designs the stroke length of the cylinder is alo to be designed at this stage.

Stroke length calculation

As it has been explained already the pressure increases to 4 times and the area is 2 times. Thus if the master cylinder utilizes 100cc of the fluid then the power transmitted by the fluid is only 25cc. Therefore 1/4 times the volume is reduced.

In the design of the cylinder described above a stroke length of 100mm is given at the Master cylinder. As per the ratio 25mm stroke is available at the slave piston. Thereby the machine will have a stroke length of 25mm.

DESIGN AND FABRICATION OF PRESS FRAME:

This is the structure above which the cylinder is to be fixed. The cylinder exerts a force of 50 tons apart from its own weight. To take up the load without fail the structure is given a factor of safety 2. The complete structure is to be designed for 100 tons that would facilitate us to use it further with higher load capacities. At the same time that would not have a chance of failure even though the cylinder exerts some higher load.

The press frame is designed to a compct size which will facilitate us for easy shifting of the structure. The material selected for the press frame is mild steel. The structure is fitted with a stand to fix it on the floor. There are provisions to fix up the cylinder on the top of the press frame. Required holes are drilled to fix up the cylinder with the help of bolts.

The cylinder is mounted vertically on the press frame. The design of the press frame is carried out with the help of design date book. The section modulus is calculated for the required structure and the design is carried out schematically.

Initially the height of the press frame cross section and number of plates to be welted are assumed and for the conditions the design is carried out. On the result of this design low value of section modulus is obtained. To achieve the required section modulus the asumed valves and number of plates are increased to some extent. Likewise, the design is carried out carefully. At last the resulting valve of section modulus for the design is sufficient to the required value. Hence, the values are accepted and the cross section is finalised.

Selection of channel:

The load value is 50 tons. For a factor of safety 2, the channel should be selected to withstand 100 tons. The yield stress value for mild steel is $1300 kg/cm^2$.

Load value W = 100 tons

Cross sectional area A = W/stress.

i.e., The required

cross sectional area = 1,00,000/1,300

= $76.92 cm^2$

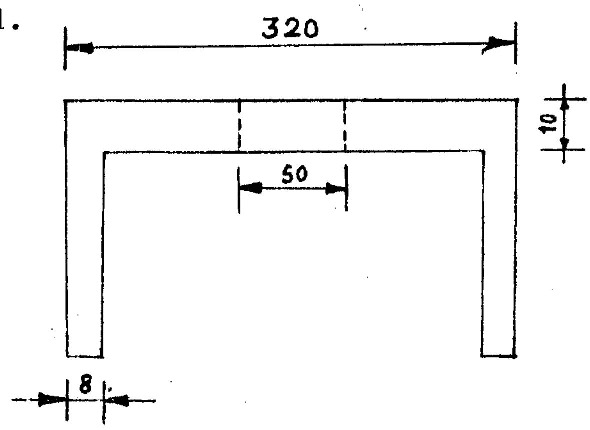
Referring to the PSG design date book the standard channel available to this cross sectional area is ISLC 300.

Cross sectional area for ISLC 300 is $42.11cm^2$.

The cross sectional area is to be increased to work on the safer side. To achieve this a plate of 8mm thick is welded with the channel. Thus the structure becomes strong enough to enough to withstand the load in case of overloading.

<u>Design of complete structure:</u>

The base of the structure should be designed to take up the load of 100 tons. To design this various books are referred and a design procedure is followed. The following is the general structure selected for the design procedure. The required base plate is 320 x 500mm and following is the design procedure adopted.



NOMENCLATURE:

W - Load exerted on the frame

L - Span Length

F_b - Bending stress

Z - Section modulus of beam

M - Bending moment

y - Centre of gravity of the structure

Ixx - Moment of inertia about the x axis

P - Load applied

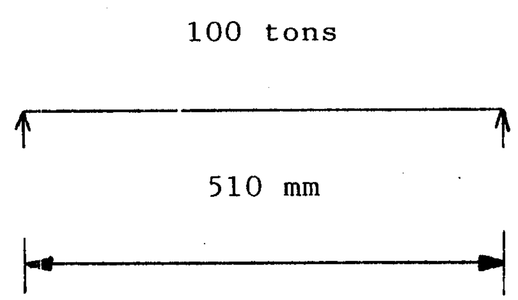
A - Cross sectional area

$f_{at\ cal}$ - Axial stress calcutaion at tension side

$f_{at\ allow}$ - Axial stress allowable at tension side.

The load 100 tons is taken by a span of 510mm

The free body diagram for this is given as below:



By working stress theory

$$\text{Load} = W \times 1.33$$
$$= 100 \times 1000 \times 1.33$$
$$W = 1{,}33{,}000 \text{ kgf}$$
$$W = 133000 \times 9.81$$
$$= 1304730 \text{ Newtons}$$

To find the bending moment,

for the free body diagram shown above the bending moment is given by,

$$\text{B.M.} = WL/4$$
$$= 1304730 \times 510/4$$
$$\text{Bending Moment} = 1.66 \times 10^8 \text{ N-mm}$$

Yield stress for

$$\text{mild steel } F_b = 0.66\ F_y$$
$$F_b = 0.66 \times 250$$
$$F_b = 165 \text{ N/mm}^2$$

Required section modulus Z is given by

$$Z \text{ required} = M/F_b$$
$$= 1.66 \times 10^8/165$$
$$= 1.006 \times 10^6 \text{mm}^3$$

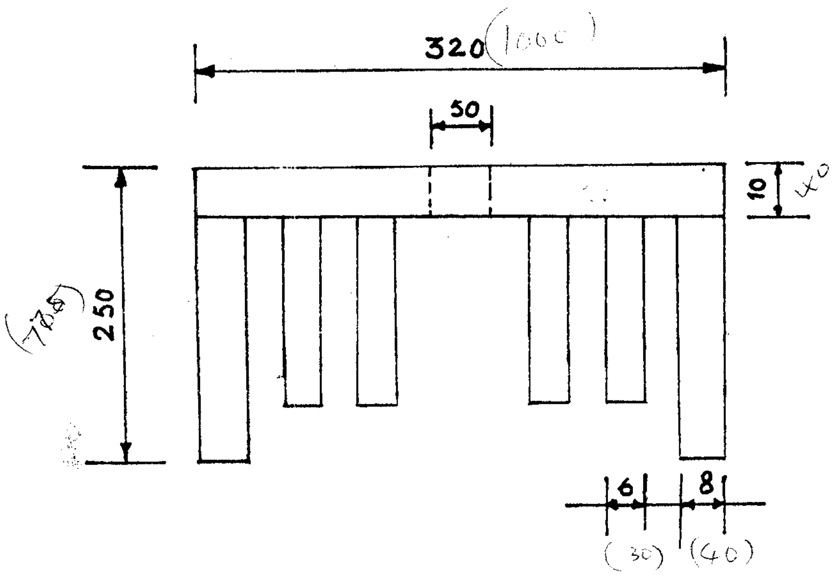
Section modulus

$$\text{of beam} = 1006 \text{ cm}^3$$

By trial and error method the cross section is found.

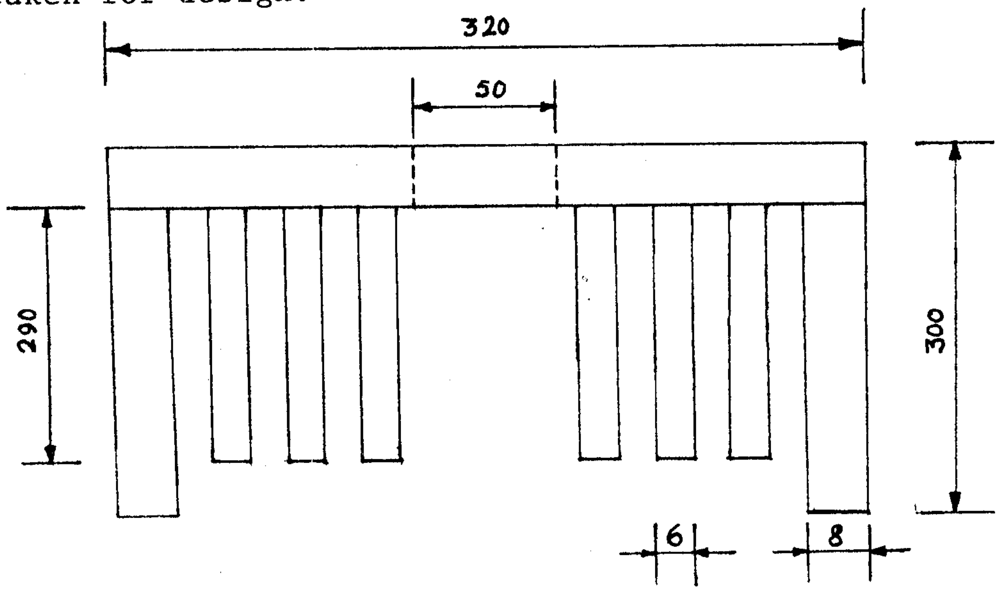
Initially the height of the structure is assumed to be 250mm and the calculations are carried out and two plates of 240mm is welded as shown in Fig.

Obtained Z value = 511.813 cm^3



As the designed values are not to the required extent the height of the structure is further increased and the same procedure is followed.

Following diagram illustrates the structure taken for design.



As per the figure shown above 6 plates of each 6mm is welded under the base plate. To find the section modulus the centre of gravity is found first.

For the above drawn structure

Centre of gravity $\bar{y} = a_1y_1+a_2y_2+..../a_1+a_2+a_3+...$

$$\bar{y} = \frac{320x10x5 + 2x300x160 + 6x290x6x155-50x10x5}{270x10 + 2x8x300 + 6x290x6}$$

$\bar{y}$ = 2399700/17940

$\bar{y}$ = 133.76mm

To find moment of inerties about x axix

$$I_{xx} = \frac{1}{12} \times 321 \times 10^3 + 321 \times 10 \times (128.76)^2 +$$

$$+ \; 2 \times \frac{1}{12} \times 8 \times 300^3 + 2 \times 300 \times 8 \times (26.24)^2$$

$$+ \; \frac{6}{12} \times 6 \times 290^3 + 6 \times 290 \times 8 \times (21.24)^2$$

$$- \; \frac{1}{} \times 50 \times 10^3 + 50 \times 10 \times (128.76)^2$$

$$I_{xx} = \underline{\mathbf{163703862\ cm^4}}$$

To find the section modulus of the structure

$$Z = \frac{I_{xx}}{y}$$

$$Z = \frac{163703862}{133.76}$$

$$= 1223862.6\ mm^3$$

$$Z = \underline{1223.86\ cm^3}$$

For the section to be in safe condition the calculated section modulus should be greater than that of the required value. For the required values,

$$Z_{required} = 1006\ cm^3$$

$$Z_{calculated} = 1223.86\ cm^3$$

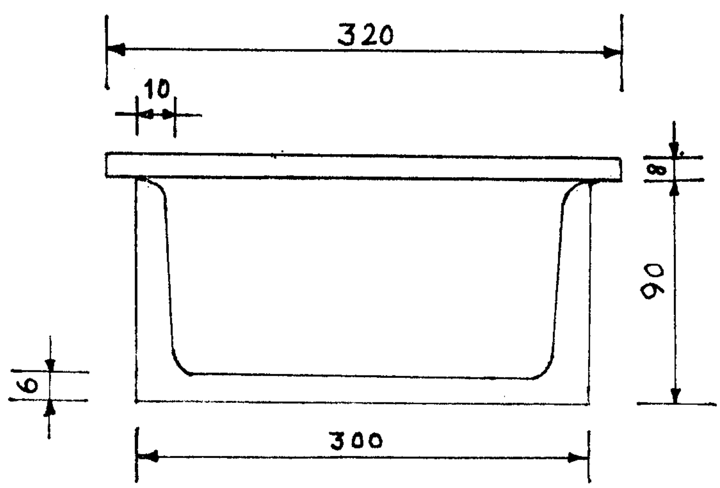
$Z_{calculated} > Z_{required}$ hence design is safe.

The daylight of the press frame is fixed a fixed as 610mm. The workpiece size that can be admitted between the column is 500mm. Thus the height of the column comes around 1000mm. The column has to be designed to take up the axial load.

The column is designed to withstand the axial load of 50 tons in each. The following design procedure satisfies that.

DESIGN OF COLUMN:

To check for axial load,



Area of cross section = 300 x 6 + 84 x 10 x 2 + 300 x 8

= 5880 mm^2

To find centre of gravity about Y axis

$$\bar{Y} = \frac{a_1 y_1 + a_2 y_2 + \cdots}{a_1 + a_2 + a_3 \cdots}$$

The following condition is established to satisfy the column to take up the axial load of 50 tons.

$$\frac{f_{at\ cal}}{f_{at\ allow}} \leq 1$$

ie.,

$$f_{at\ cal} \leq f_{at\ allow}$$

ie.,

$f_{at\ cal}$ is the calculated value of tensile strenth

$f_{at\ allow}$ is the max, allowable value for the structure takenfor chcking

$$f_{at\ cal} = \frac{P}{A}$$

$$f_{at\ allow} = 0.6\ fy$$

where

P = is the max load applied in column

A = is the cross sectional area available

f_y= is the yield strength for the material

$$f_{at\ cal} = \frac{P}{A}$$

$$= \frac{50 \times 1000 \times 10}{5880}$$

$$= \underline{85.03\ N/mm^2}$$

$$f_{at\ allow} = 0.6\ f_y$$

$$= 0.6 \times 250$$

$$= \underline{150\ N/mm^2}$$

Hence

$$f_{at\ cal} < f_{at\ allow}$$

Therefore it is concluded that the design is safe and a force of 50 tons can be applied on the column.

DESIGN OF HYDRAULIC PUMPS:

Design of an engineering product is carried out with the intention of manufacturing it economically In many cases emphirical equation based on experimental results have been used. In some cases, slight modifications have been necessary for the case of fabrication The factors like assembly of various parts, replacement of worn parts, allowance for wear, precision for lubrication etc., have been considered.

Pumps inject energy into the hydraulic system by converting the kinetic energy at the input into the hydraulic energy. Due to the external resistance the pump creates the flow and the pressure which is known as positive displacement pumps. The positive displacement pumps deplacing a fixed volume of fluid.

As per the significance of project the pump is designed to fabricate at very low cost. Moreover the advantage of the pump is to operate without any pwer. Now-a-days a machine working without any power is unimaginable.

It is not a common practice for us to use the manually operated pump. Though it is manually operated the output is 100 kg/cm2 which in turn satisfies our requirement.

As per the requirement of the machine the pump output should be 25 kg/cm^2 at low pressure side and 100 kg/cm^2 at high pressure side. In the following pages the design of the pump is dealt elaborately.

Reservoir dimensions:

To achieve the pressure of 100 kg/cm^2 the reservoir capacity should be atleast 3 lit i.e. 3000cm^3

For the compactness of the pump the base diameter of the pump the base diameter of the pump may be assumed as 180mm i.e.,

Reservoir diameter D = 100mm

The height of the reservoir is assumed to be 90mm i.e.,

Height of the reservoir = 90mm

To find the capacity:

$$\text{Volume of the reservoir } V = A \times h$$
$$= \pi/4 \ (180)^2 \times 90$$
$$= 2290221 \ mm^3$$
$$= 2290.2 \ cm^3$$
$$\text{Volume} = 2.29 \text{ litres}$$
$$= 2.5 \text{ lit.}$$

The idea behind the pump to achieve two pressures is that a handle is operated on the heads of two plungers.

Two plungers of different size is designed to take up the liquid from the reservoir and pressurises the liquid.

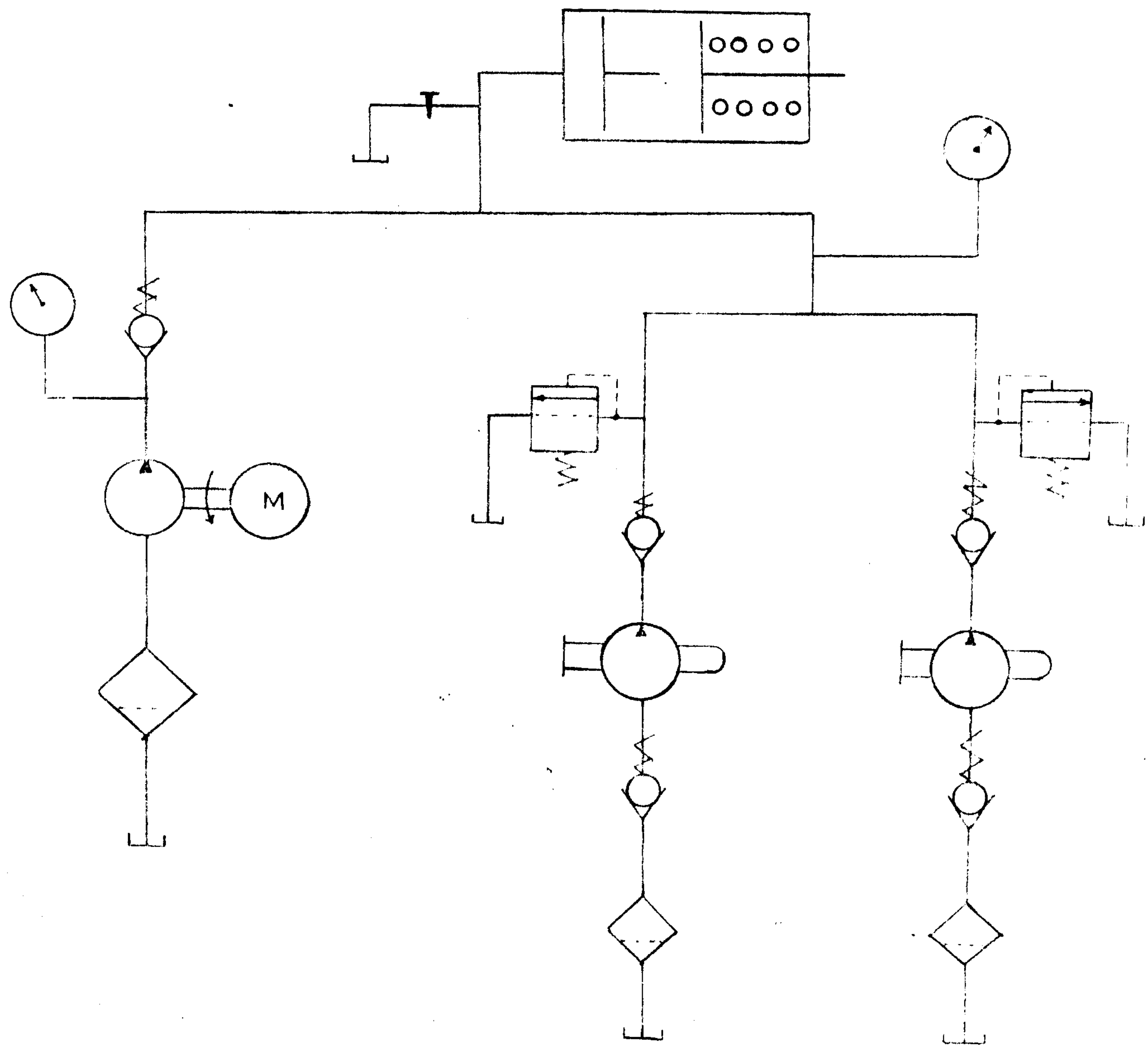
To achieve this aspect we may have two relief valve which in turn help us to reduce the pressure at the plunger whose pressure valve needs the limit.

Separate ball and spring arrangement is made as the pressure reducing valve. At the outlet of the plungers there are spring loaded balls which has the spring pressure equal to the optimum values of the plunger pressures.

As per the set up whenever there is an increase in pressure the spring loaded balls are moved up and the fluid takes the path to reach the cylinder.

The following hydraulic circuits explains clearly about the function of the pump.

HYDRAULIC CIRCUIT



The circuit illustrates the operations of the pump clearly. It is clearly explained from the circuit that there are two plungers developing two pressures. Two relief valves are suited for two pressures of the pump.

Whenever there is any increase in pressure the spring loaded balls are moved upon and the oil returns to the reservoir through the return path. Apart from this whenever the whole system pressure is to be relieved there must be a separate relieve valves. This relieve is set up at the common outlet for both the pressures. The lever is to be operated to relieve the pressure of the pump.

The standard size of balls such as 1/2", 1/4", 3/8" are selected so that there won't be any difficulty in obtaining that. The valve ways are constructed such that to accomodate the balls. Whenever the balls move because of the liquid pressure once again it retains its position and seats perfectly.

In the design there are some provisions made at the bottom of the pump i.e., at the reservoir side to fix it up at the required places. A bourdon type pressure gauge is also fitted with the pump to indicate the pressure.

SPECIFICATION:

Working load	=	50 tons
Maximum shear area (st.45)	=	1500 mm^2
Stroke length	=	25mm
Work piece size Admit between columns	=	500mm
Day light	=	500mm
Table dimension	=	500 x 320mm

<u>HYdraulic Cylinder</u>

Master cylinder diameter	=	127mm
Stroke length	=	100mm
Working Pressure	=	100 kg/cm^2
Slave cylinder diameter	=	127mm
Stroke length	=	25mm
Working pressure	=	400 kg/cm^2

<u>Power Pack</u>

i) Power operated pump

Output	=	9 lit/min
Working pressure	=	20 kg/cm^2
Motor	=	1.0H.P/3phase/1440 rpm
Capacity	=	30 litres

ii) Manual pump

	Volume/stroke	Max.Pressure
Low pressure pump	29.4cc	25 kg/cm^2
High pressure pump	8.233cc	100 kg/cm^2

Reservoir capacity	=	3 lit
Floor space required	=	l x b x h
	≐	700 x 700 x 180
Maximum weight of m/c without oil	=	950 kg.

COST ESTIMATION

1. Power operated pump (power pack) : Rs. 8150

2. Press frame

   Material cost

Channel	:	Rs. 1260
Plates	:	Rs. 4500
Welding	:	Rs. 800
Stress relieving	:	Rs. 500
Others	:	Rs. 300

3. Base frame

L-angle	:	Rs. 900
Welding	:	Rs. 150

4. Hydraulic cylinder

Material for seamless tube	:	Rs. 1500
Other Items	:	Rs. 1500
Machining charge	:	Rs. 1500
Purchasing items	:	Rs. 1500

5. Manually operated pump

Material cost	:	Rs. 750
Machining cost	:	Rs. 750
Purchasing items	:	Rs. 500
Total		Rs.24560

BIBLIOGRAPHY

1	Industrial Hydraulics	:	John Pippenger Tyler Hicks
2	ABC's of Hydraulics	:	Harry L.Stewart
3	Workshop Technology	:	S.K. Hajra Choudhury S.K. Rose A.K. Hajra Choudhury
4	Design of Steel structure Vol I	:	Punmia Ramchandra
5	Strength of materials	:	S. Ramamrutham
6	PSG Design Data Book		
7	Indian Standard	:	Code of practice for General Construction in Steel.
8	Steel Tables	:	S. Ramamrutham

CONCLUSION

This project was initiated to study the feasibility of developing such a higher load which will be of great help to the medium and small scale industries which are coming up in large numbers.

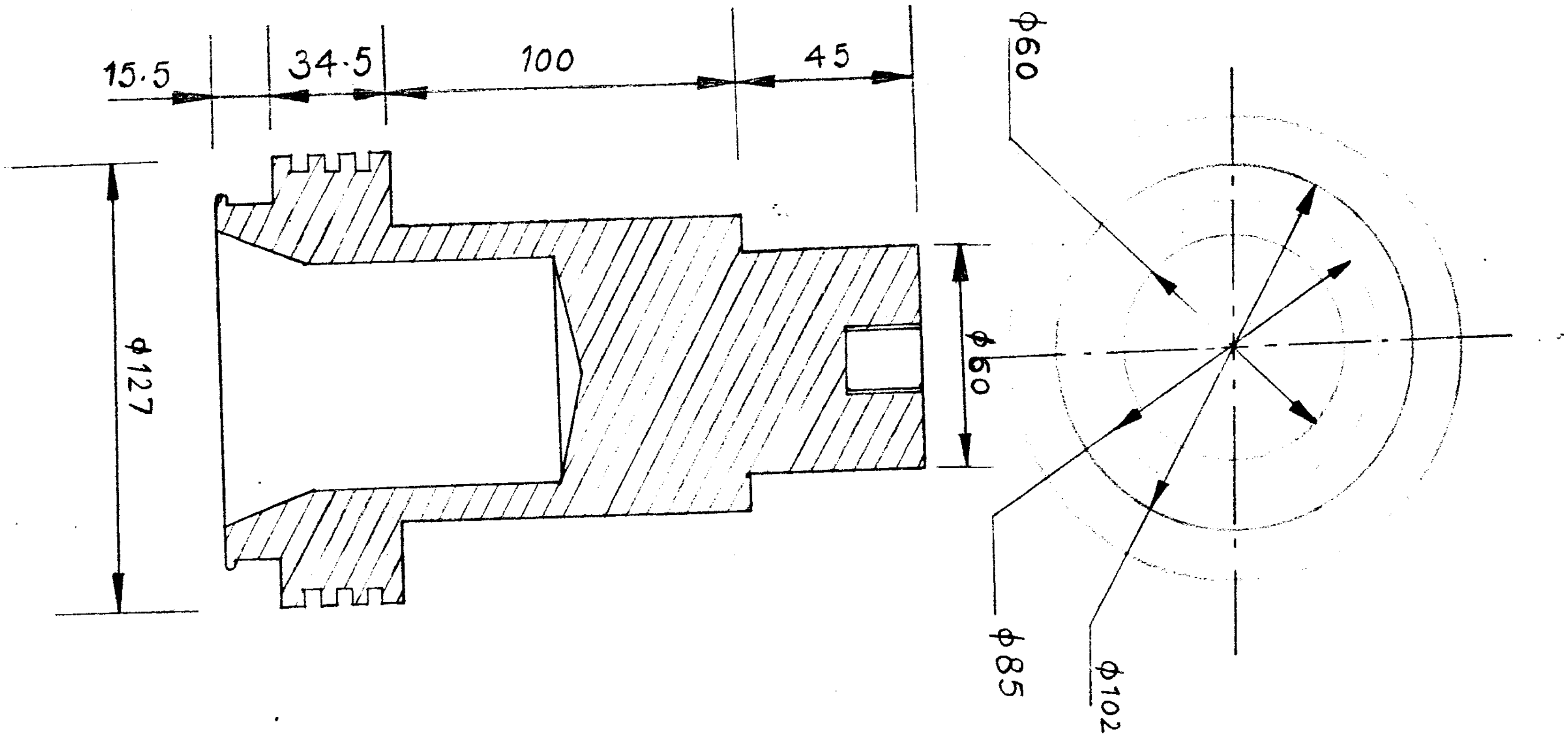
The idea developed is a feasible one. The machine is capable of doing both punching and shearing machine. The operation depends on the tool and die set up. This shows the versatility of the machine.

The same pump can be used for any other systems which requires about 100 kg/cm^2 pressure. The cylinder thickness is designed such that it would not fail though some higher pressure is applied. The press frame is also designed to take up the load of 100 tons which is twice that of the required one.

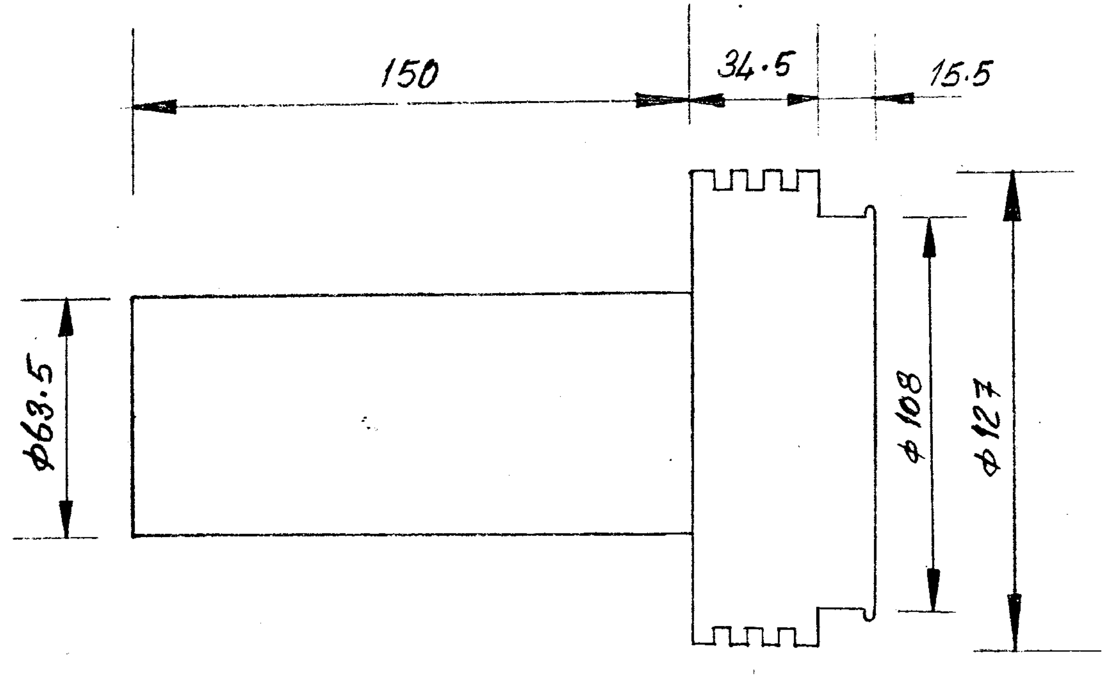
The above details clearly indicates that the machine can also be in future for higher load capacities.

PART LIST

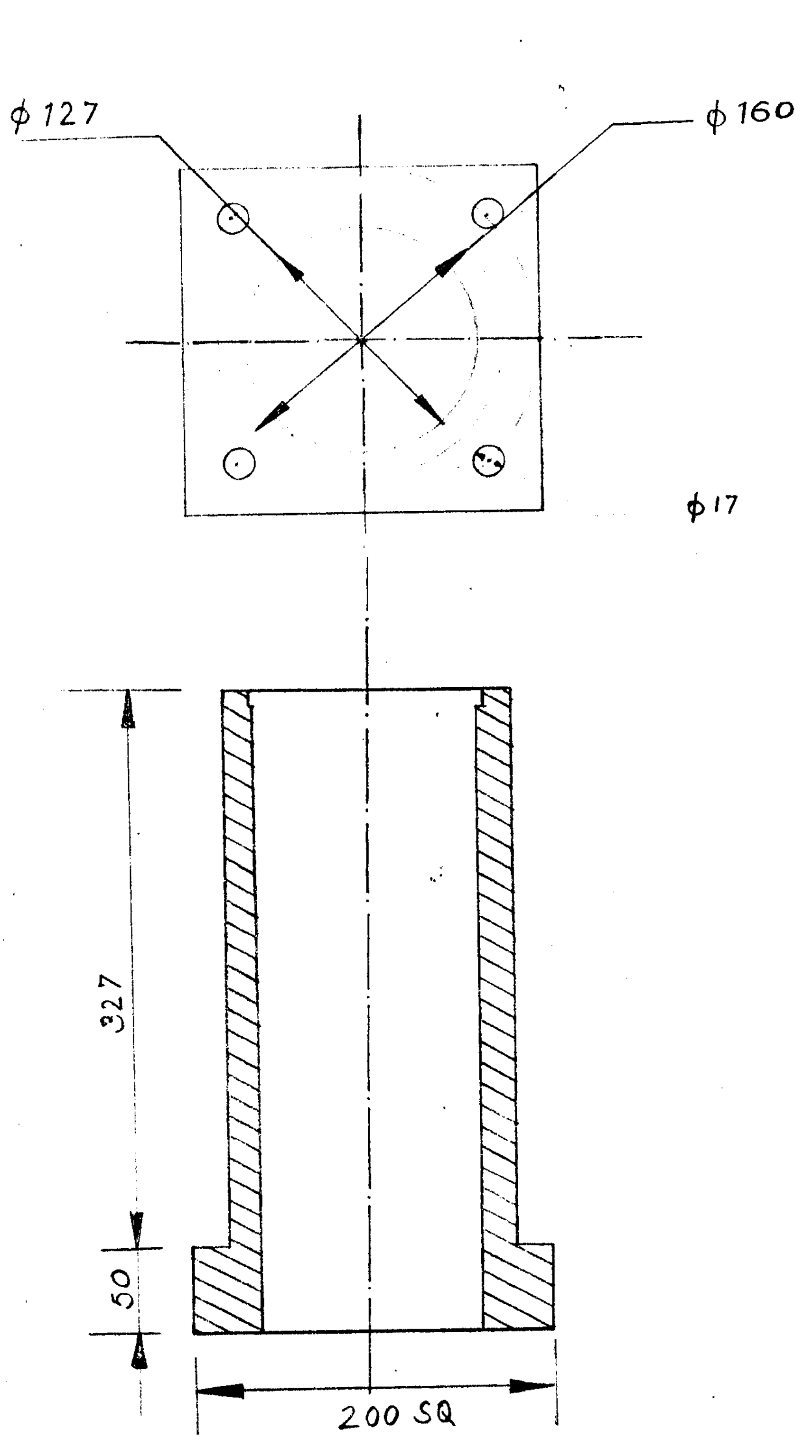
S.NO	DRAWING NUMBER	DESCRIPTION OF PARTS	QTY	MATERIAL	MANUFACTURED	PURCHASE
1	HPS 50-01-01	Base frame	1	st 32	/	
2	HPS 50-02-01	Reservoir	1	st 32	/	
3	HPS 50-02-02	Pump Body	1	c 45	/	
4	HPS 50-02-03	High pressure plunger	1	15Ni2cr/mo15	/	
5	HPS 50-02-04	Low pressure plunger	1	15Ni2cr/mo15	/	
6	HPS 50-02-05	Piston seal	1	Neoprene rubber		/
7	HPS 50- 02-06	Pump cover	1	c 45	/	
8	HPS 50-02-07	'O' ring	1	Neoprene rubber		/
9	HPS 50-03-01	Hydraulic cylinder	1	c 45	/	
10	HPS 50-03-02	Master piston	1	c 45	/	
11	HPS 50-03-03	Slave piston	1	c 45	/	
12	HPS 50-03-04	Cylinder cover	1	c 45	/	
13	HPS 50-03-05	'O' ring	13	Neoprene rubber		/
14	HPS 50-03-06	Piston seal	4	Neoprene rubber		/
15	HPS 50-03-07	Circlip	2	st 60	/	
16	HPS 50-03-08	Spring	4	c 60		/
17	HPS 50-03-09	Gland	2	c 45	/	
18	HPS 50-04-01	Press frame	1	st 32	/	



K.C.TECH	SLAVE PISTON	SCALE 1:2
B.E. PROJECT	HYDRAULIC CYLINDER	



K.C. TECH	MASTER PISTON	SCALE 1:2
B.E. PROJECT	HYDRAULIC CYLINDER	



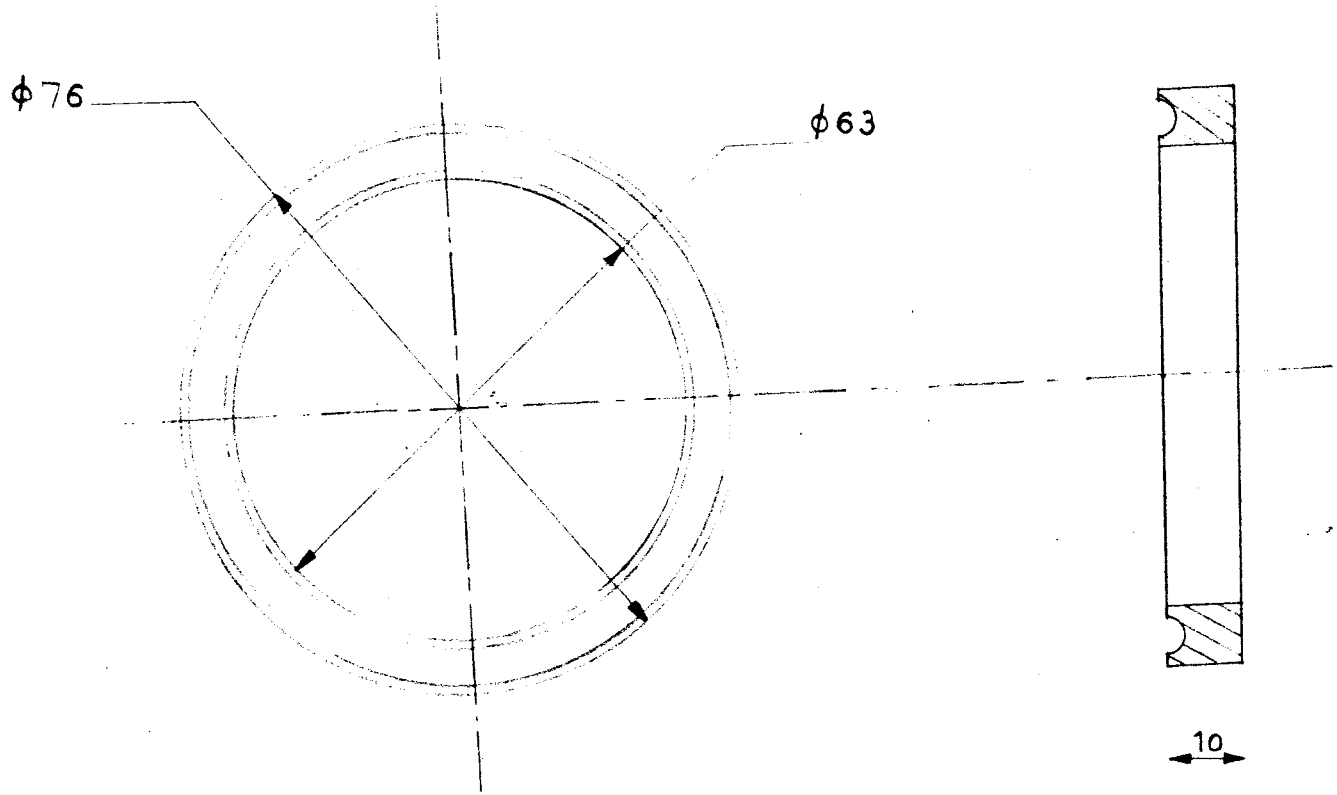
SCALE 1: 4

CYLINDER

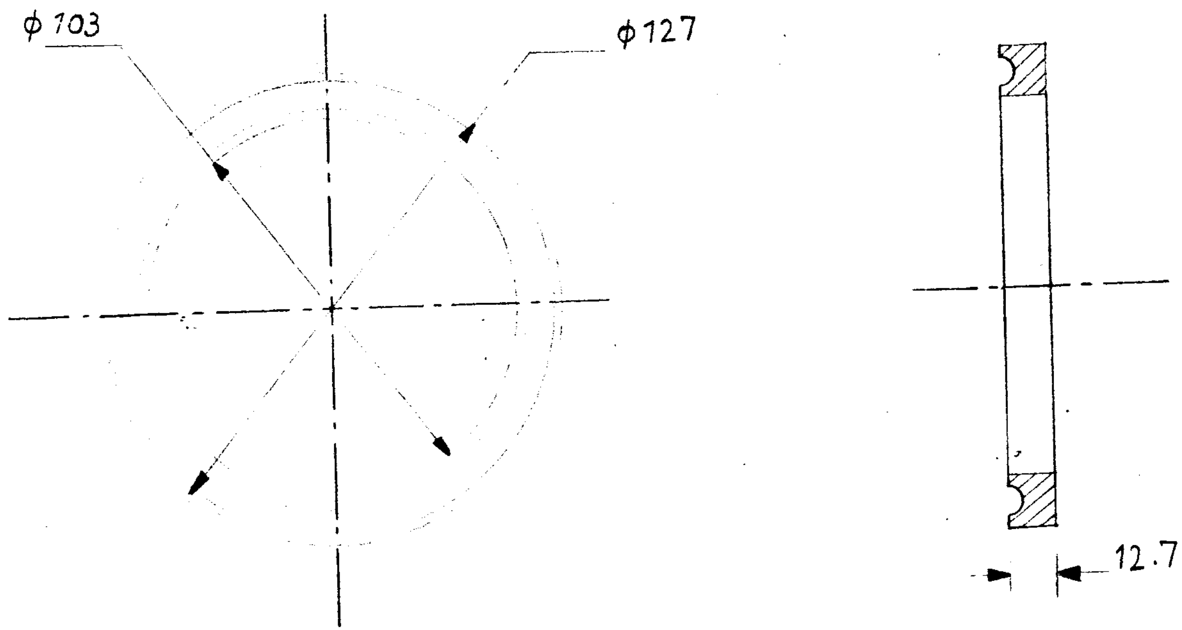
HYDRAULIC CYLINDER

K C TECH

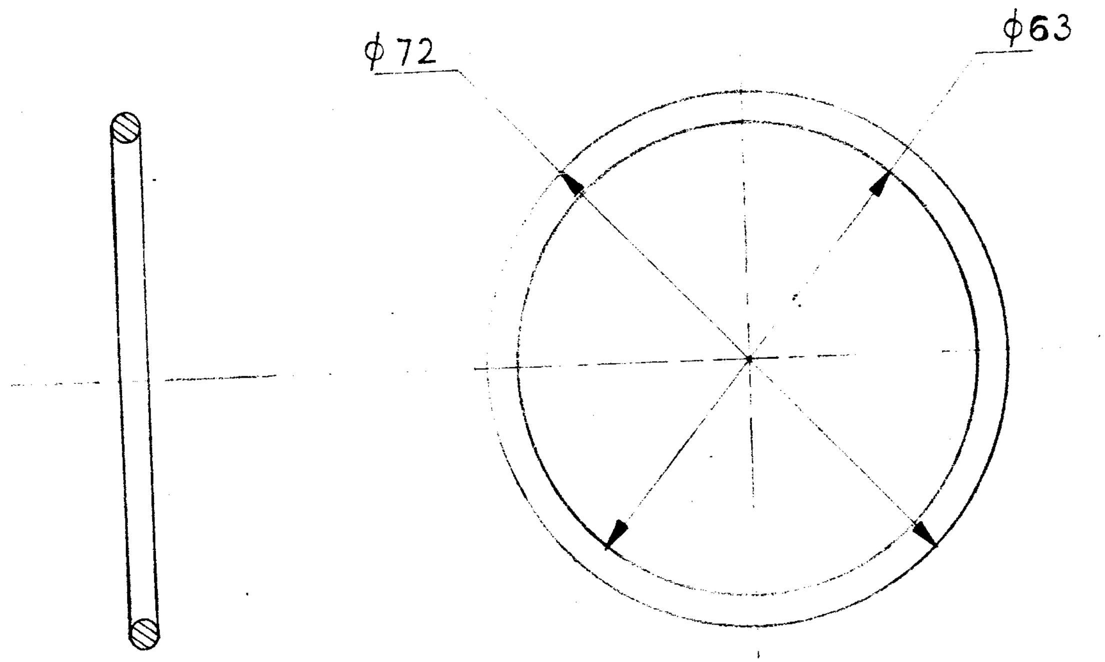
B.E. PROJECT



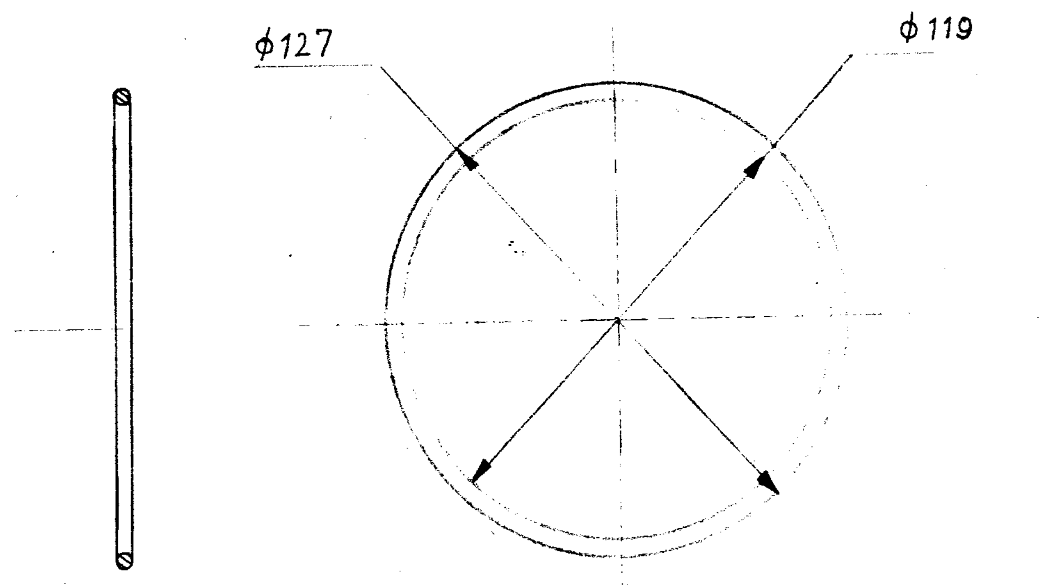
K.C. TECH	PISTON SEAL	SCALE:-1:1
B.E. PROJECT	HYDRAULIC CYLINDER	



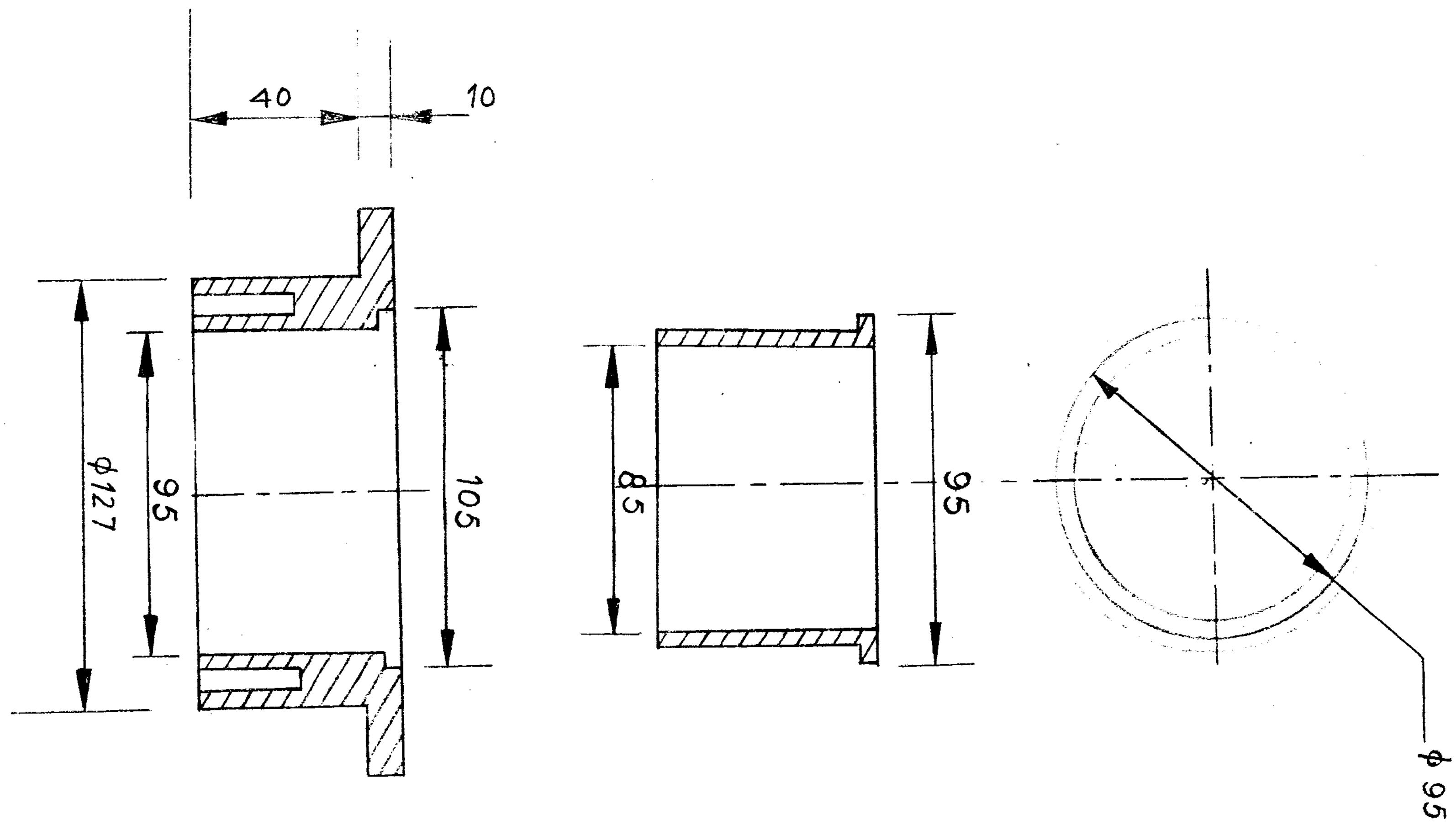
K.C.TECH	PISTON SEAL	SCALE :- 1 : 2
B.E.PROJECT	HYDRAULIC CYLINDER	



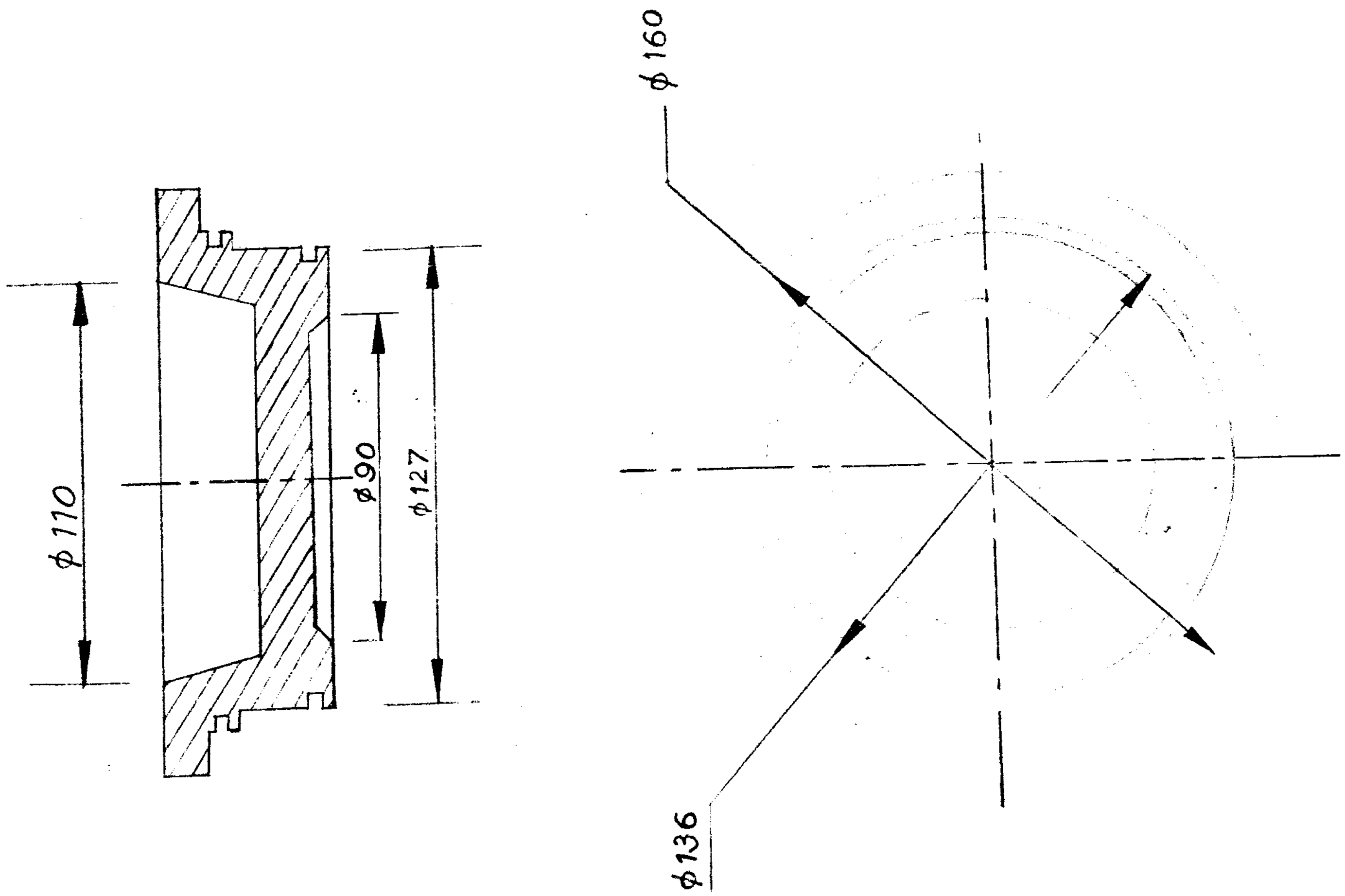
K.C. TECH	'O' RING	SCALE :- 1:1
B.E. PROJECT	HYDRAULIC CYLINDER	



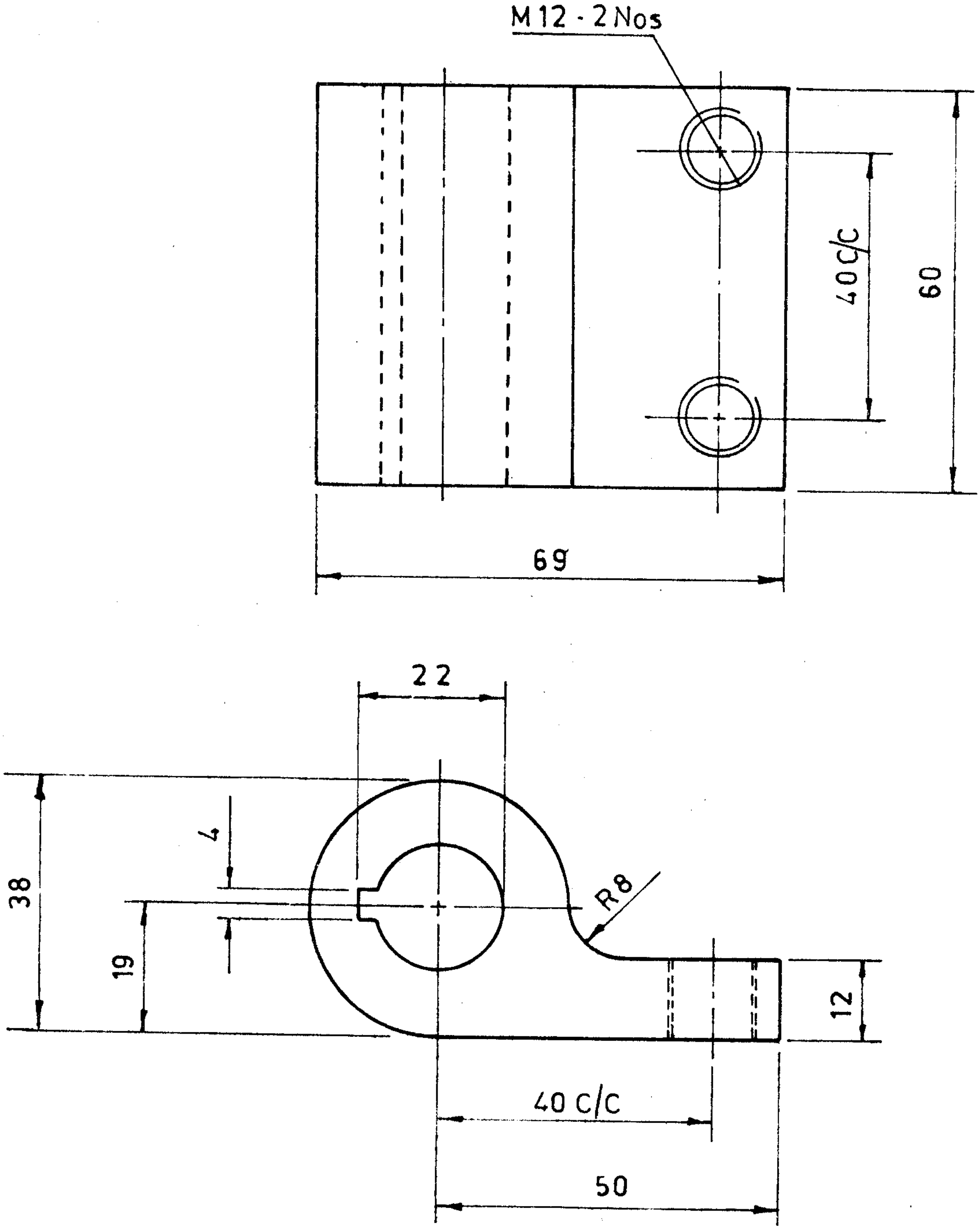
K.C.TECH	'O' RING	SCALE:- 1:2
B.E. PROJECT	HYDRAULIC CYLINDER	



K.C. TECH	GLANDS	SCALE ÷ 1:2
B.E. PROJECT	HYDRAULIC CYLINDER	



K.C. TECH	TOP COVER	SCALE :- 1:2
B.E. PROJECT	HYDRAULIC CYLINDER	

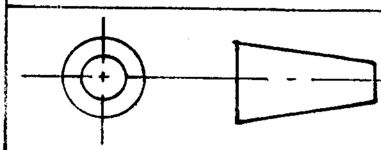


BRACKET

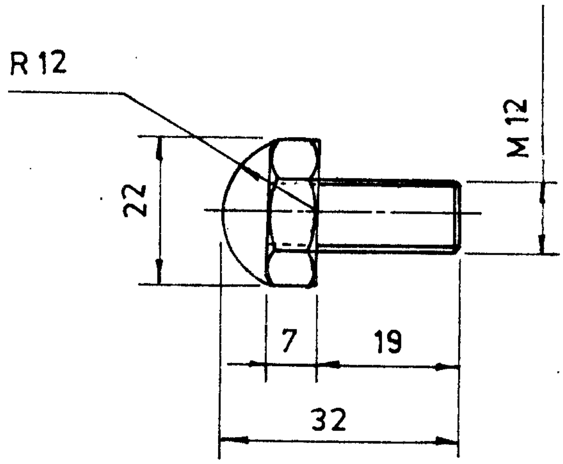
HYDRAULIC PUMP

K.C TECH.

SCALE : 1:1



BE PROJECT.



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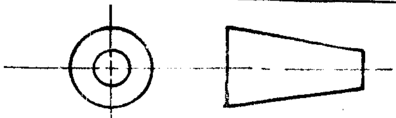
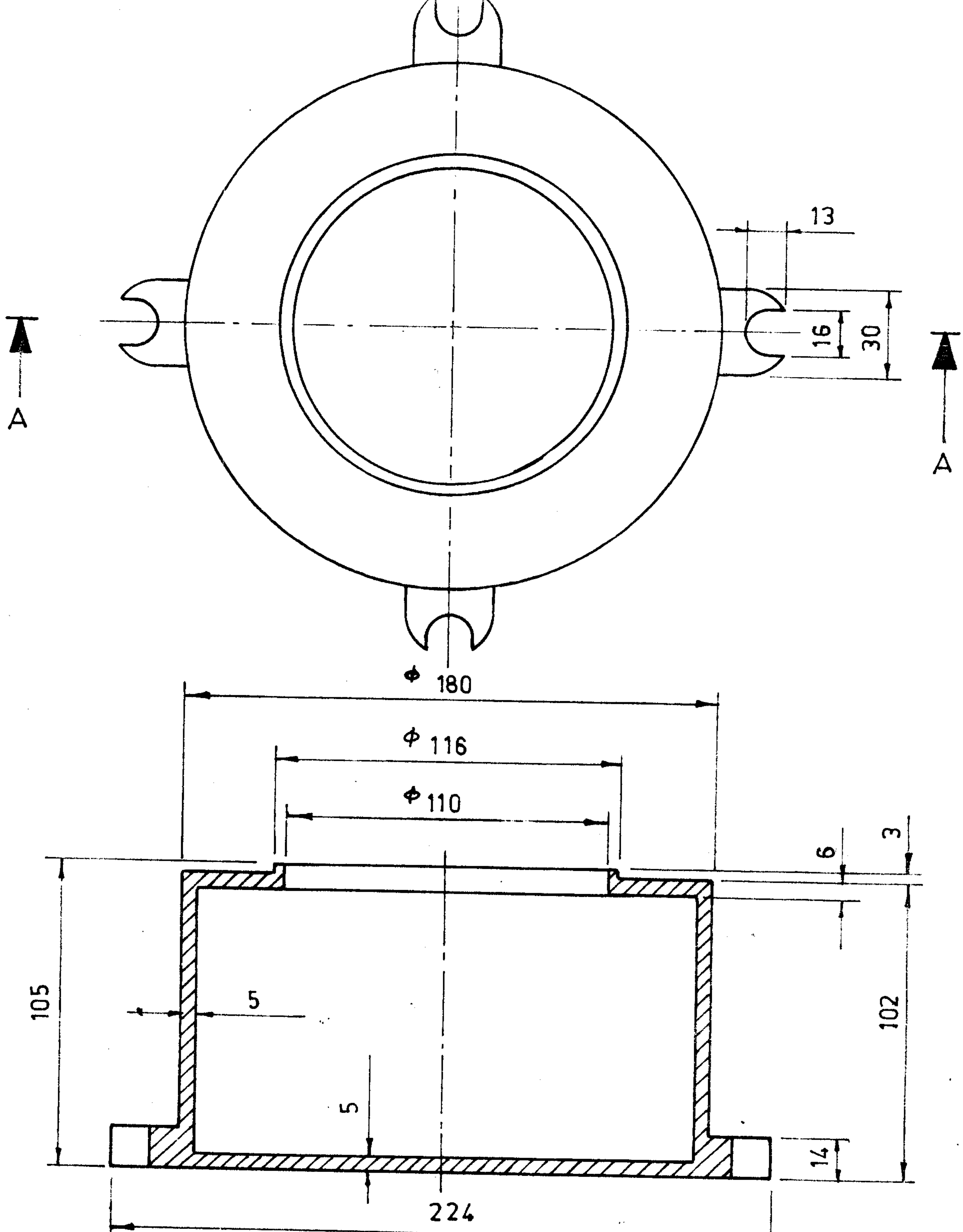
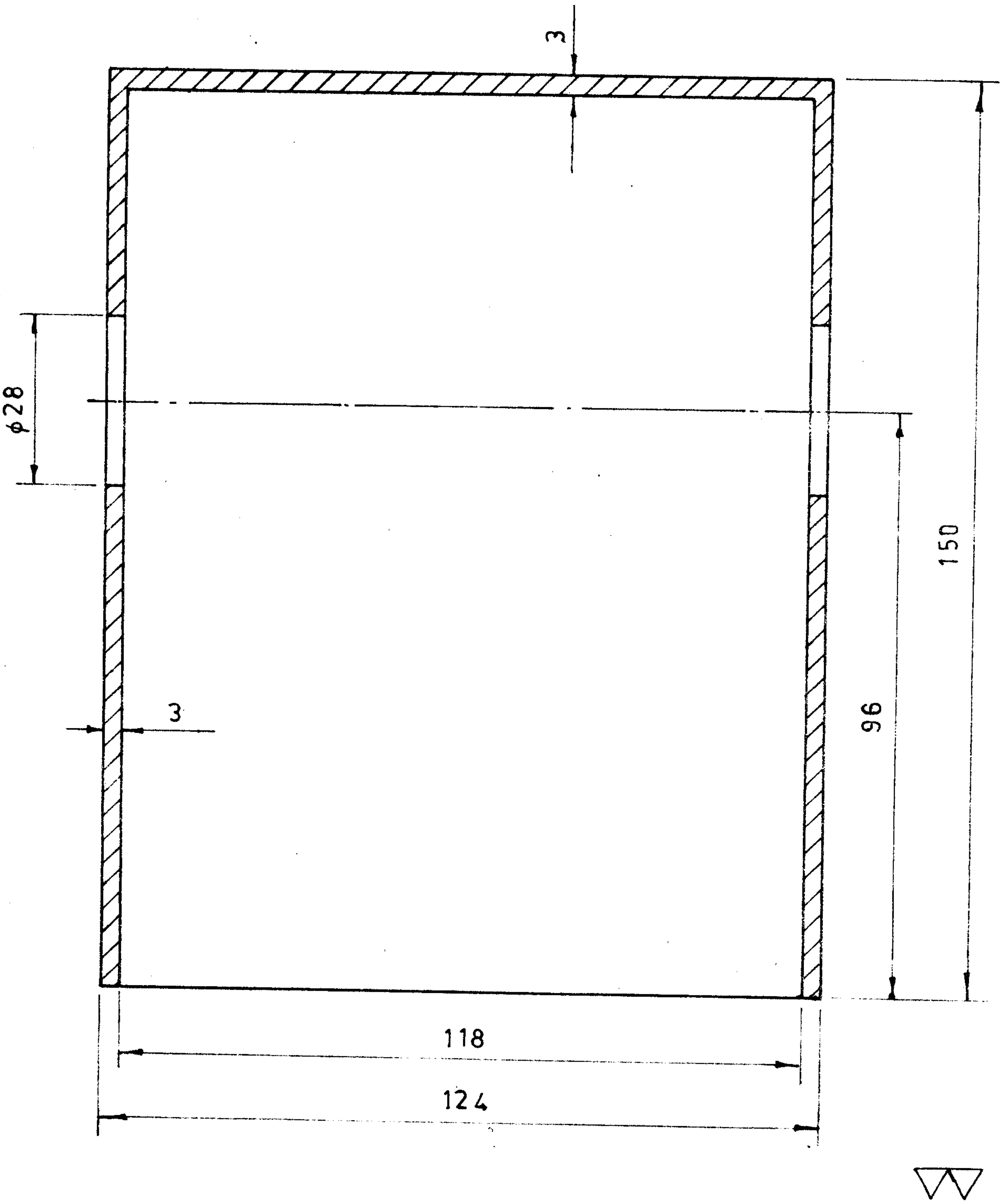
BOLT	
HYDRAULIC PUMP	K·C TECH,
SCALE: 1:1	
	B·E PROJECT.

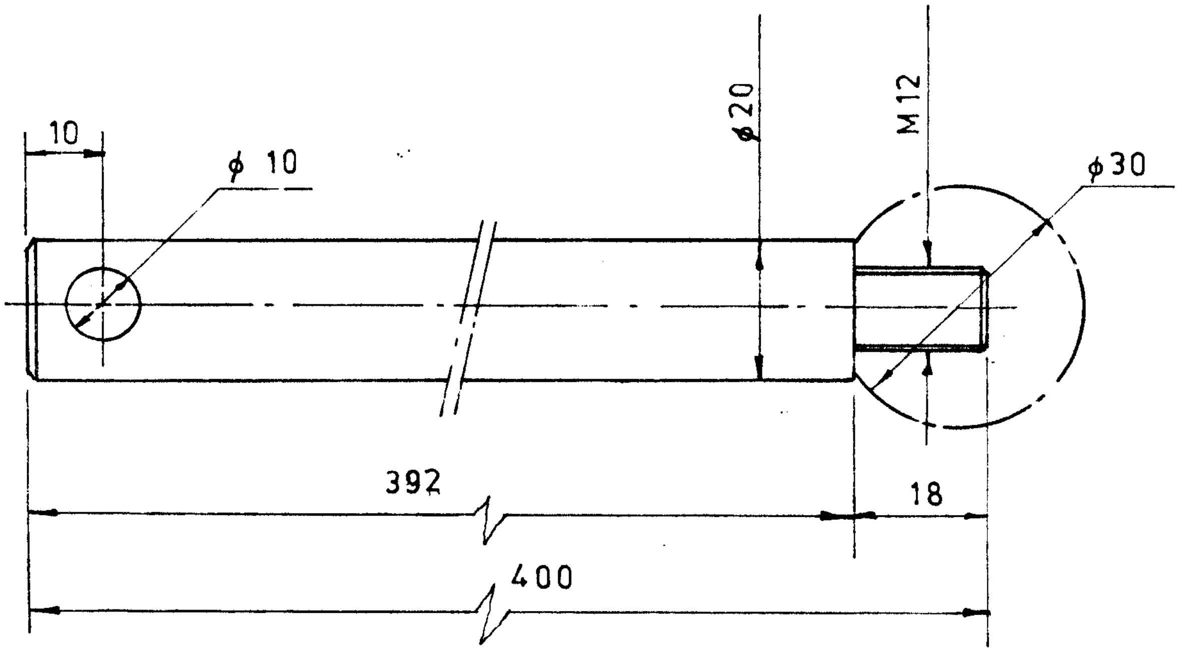


Section-A-A

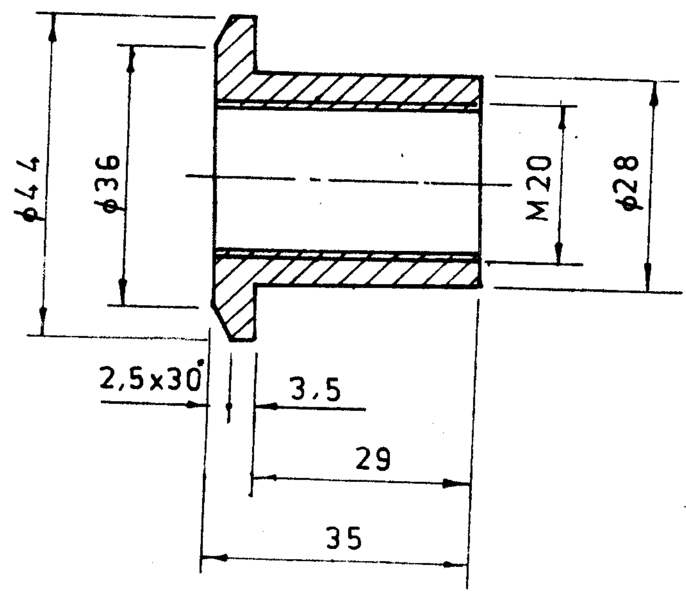
RESERVOIR	
HYDRAULIC PUMP	K·C-TECH,
SCALE: 1:2	
	B·E PROJECT.



PUMP COVER	
HYDRAULIC PUMP	K-C TECH,
SCALE: 1:1	
	B-E PROJECT.

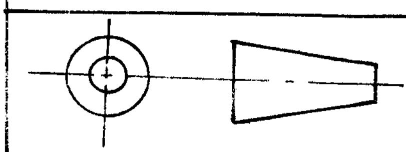


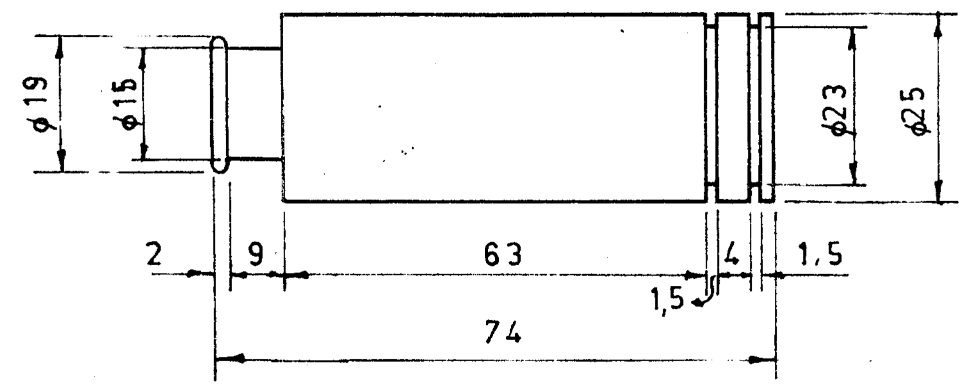
HANDLE WITH BALL GRIP	
HYDRAULIC PUMP	K·C TECH.
SCALE: 1:1	
	B·E PROJECT.

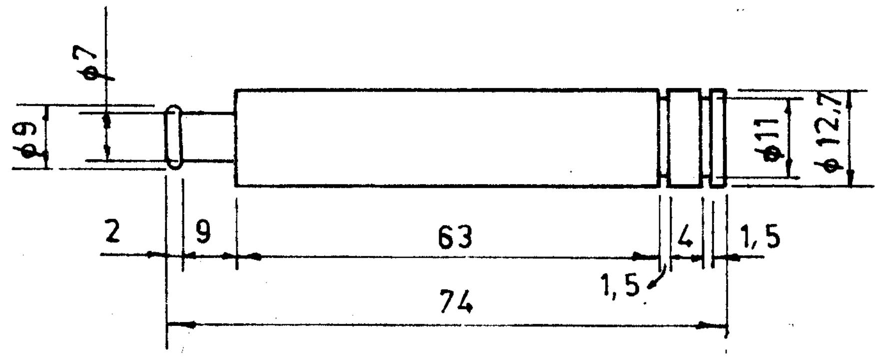


USED ON

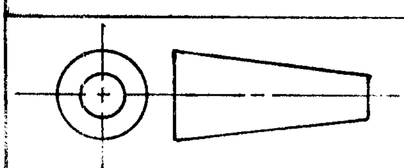
QTY-2 Nos

SHAFT BUSH	
HYDRAULIC PUMP	K.C TECH.
SCALE: 1:1	
	B·E PROJECT.





PLUNGERS

HYDRAULIC PUMP	K·C TECH.
SCALE: 1:1	
	B·E PROJECT.