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General Editor : P. ABBOTT, B.A.

EXAMPLES
IN
ENGINEERING DRAWING

VOLUME 2

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THE TECHNICAL COLLEGE SERIES

EXAMPLES IN ENGINEERING DRAWING

VOLUME 2

(Second Year Course)

By

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GENERAL EDITOR'S FOREWORD

Technical education stands on the verge of a great advance. Throughout the country there is widespread recognition of the necessity for a great expansion of the facilities which are available for systematic training for science and industry. There is also a general acceptance of the well-founded conclusions of experts that the economic prosperity of this country will, more than ever before, be dependent upon the efficiency and adaptability of our system of scientific and technical training.

It is the hope and ambition of those who have planned this series of technical books that it will meet the demands for new books which will follow these developments. New measures require new books and it is hoped that the series will not only assist in meeting these requirements but will incorporate those new methods and processes which have been introduced during the war years.

P. ABBOTT.

AUTHOR'S PREFACE

The examples in Volume 2 are a continuation of those which appeared in Volume 1. The student is now expected to go a step further in producing the finished working drawing, by giving all dimensions in their correct position on the drawing, to have a knowledge of tolerances on dimensions, to be able to make a schedule of parts when required, and also to indicate where the parts shall be machined.

Several examples of structural details are given, to help students in the structural industry.

Sufficient information is included to assist students to attempt the exercises, which include curves of intersection, the proportion of gear teeth, etc.

CONTENTS

DIMENSIONS

At this stage a student should be able to dimension fully a working drawing.

The main function of a drawing is to show the sizes to which the detail is to be made, so that there is no possibility of error. To do this, a few points must be remembered:—

1. All dimensions must stand out clearly on the drawing, if possible on the outside of the detail.

2. All figures should be at least $\frac{1}{4}''$ high, and the dividing line should be horizontal.

3. The figures should be placed in the middle of the dimension line, so that they may be read from the front and from the right-hand side of the drawing.

4. All lengths should be given from a datum line, especially in the case of shafts, as shown in Fig. 2, page 8. The reason for this is that, where tolerances are given, the shaft may be too long or too short, depending on whether the lower or higher tolerance has been adhered to.

5. When several circles occur, the best method is to take the dimensions outside the circles, as shown on Fig. 3, page 8. Diagonal dimensions must not be given, except in the case of a single dimension—e.g., pitch circle diameter of bolt holes.

6. Always dimension to the centre of holes from either a base line or a main centre line.

DIMENSIONS

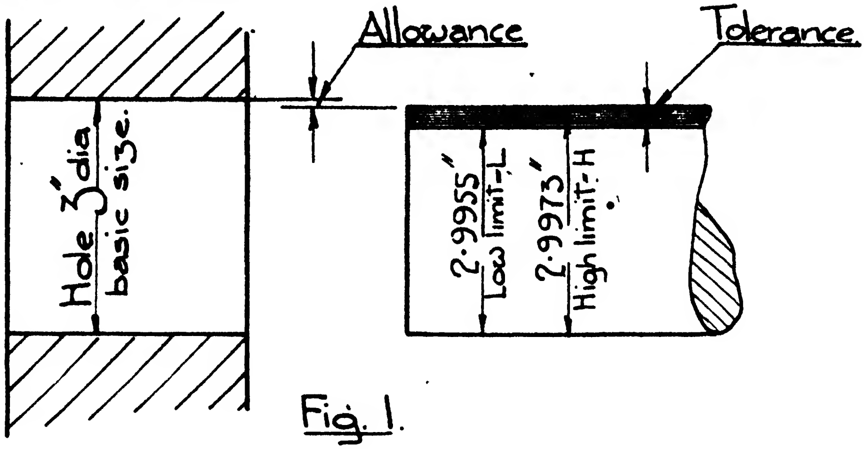


Fig. 1.

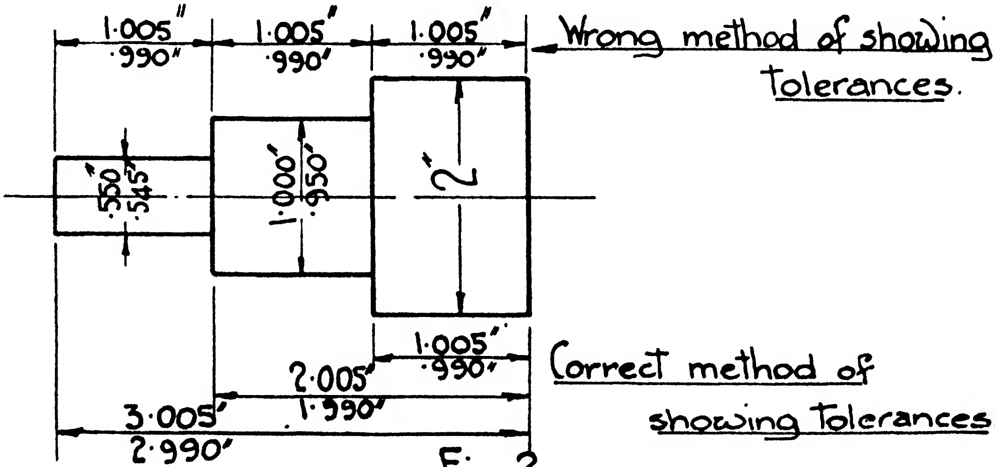


Fig. 2

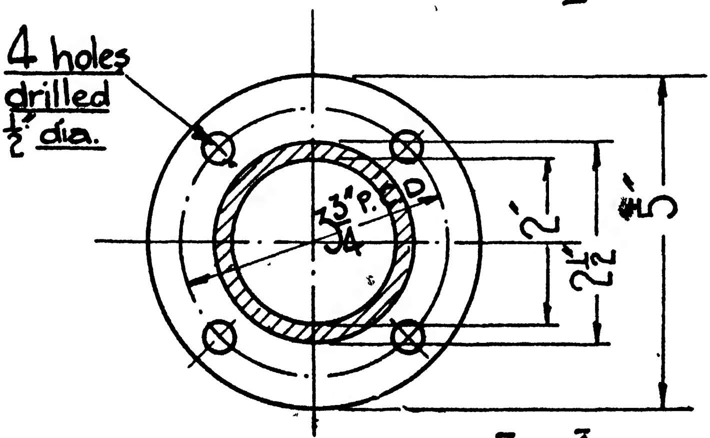


Fig. 3.

LIMITS AND FITS

All the information required on this subject may be obtained from the *British Standard Handbook*, No. 2, published by the British Standards Institution for the use of engineers. Students should study this for use in the drawing office, but a rough idea of tolerances is given for use in the examples on Fig. 1, page 10.

There are several different fits to suit different requirements, and in the case of Fig. 1, page 8, a running fit is given in which the hole is a basic size, whilst the diameter of the shaft may vary. The TOLERANCE is the difference between the high and low limits. The ALLOWANCE is the difference shown between the high limit of the shaft and the basic size of the hole, to allow for a running fit in this particular size of shaft.

Machining allowance must not be confused with the allowance on dimensions; it is the allowance on certain portions of castings and forgings where they are required to be machined, as shown in Fig. 1, page 10.

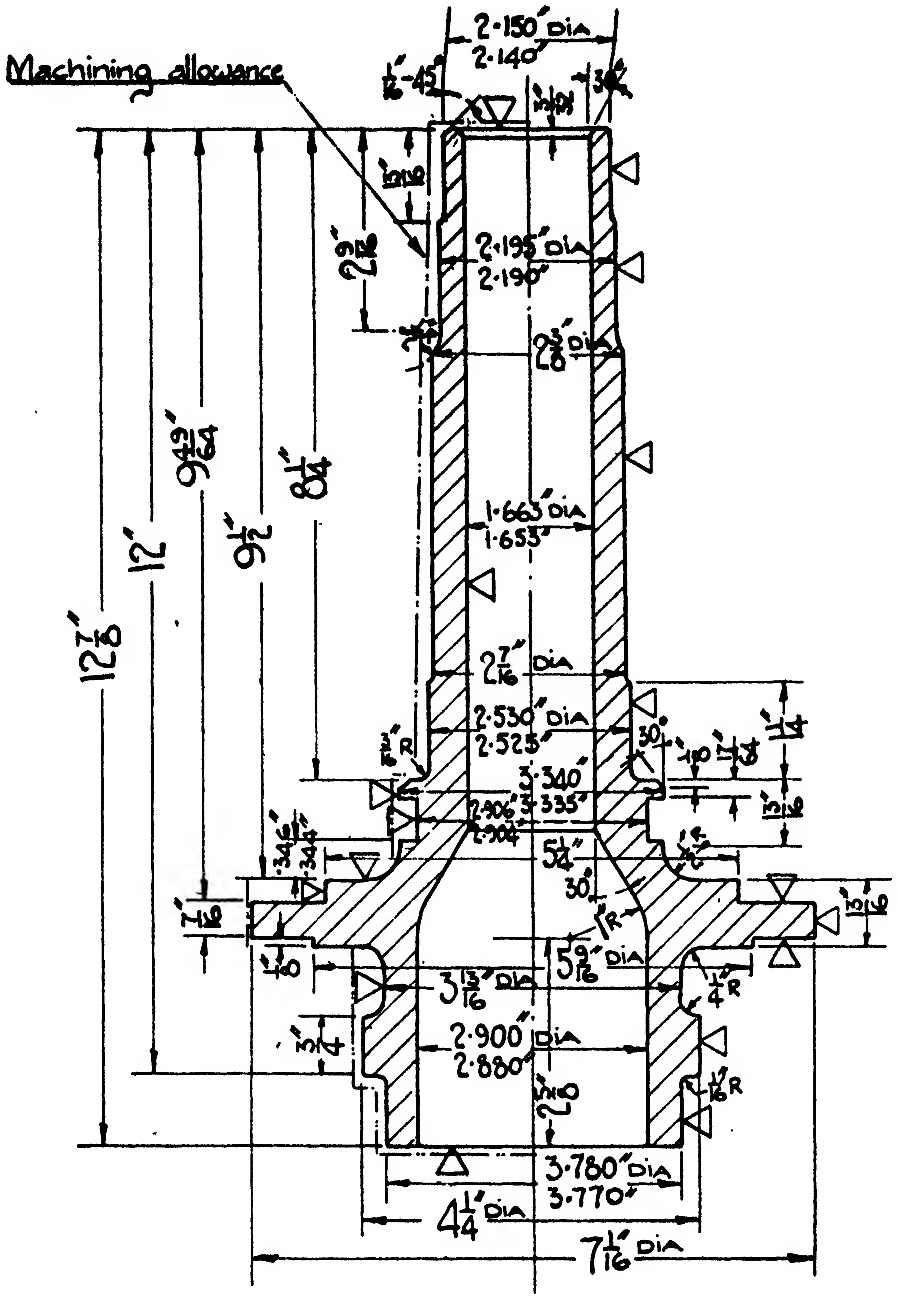

Machining allowance
2·150" DIA
2·140"
2·195" DIA
2·190"
1·663" DIA
1·653"
2·530" DIA
2·525"
3·340"
3·335"
2·906"
2·904"
2·900" DIA
2·880"
3·780" DIA
3·770"
4 1/4" DIA
7 1/16" DIA
5 9/16" DIA
3 13/16" DIA
2 7/16" DIA
12 7/8"
12"
9 43/64"
9 1/2"
8 1/4"
30°

Fig. 1

MACHINING

The tendency in modern drawing-office practice is to give as much information as possible on a working drawing with regard to the degree of finish on machined parts.

There are several methods of showing the finish required, but students are advised to adopt the method which has been standardized by the British Standards Institution, as shown on page 12, method No. 4.

In this method an equilateral triangle having sides about ¼″ long is used, with one point of the triangle touching the surface to be machined. A letter is used to indicate the particular process required.

SCALES

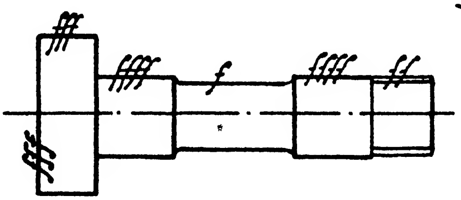
The method recommended for showing the scale on a drawing is as follows:—

Scale	full size	to be stated	1/1
„	half	„ „	1/2
„	3″ = 1 foot	„	1/4

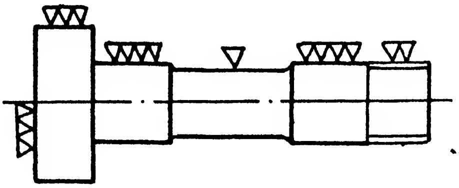
and all other scales to be shown as a fraction.

MACHINING

Method No. 1.



Method No. 2.



Method 1. Method 2.

f or ∇ = rough machining.

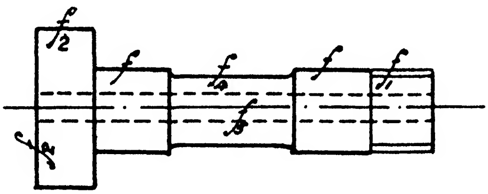
ff or ∇∇ = smooth finish.

fff or ∇∇∇ = smooth and ground finish, by polishing with emery or other abrasive.

ffff or ∇∇∇∇ = Smooth and ground finish highly honed with very fine abrasive

G = Ground. This varies according to the abrasive wheel and coolant.

Method No. 3. The fractions indicate the amount of feed on the machine.



f = finish

f_1 = $\frac{1}{32}$ "

f_2 = $\frac{1}{16}$ "

f_3 = $\frac{3}{32}$ "

f_4 = $\frac{1}{8}$ "

f_5 = $\frac{5}{32}$ "

Method No. 4.

System recommended by the British Standards Institution.

∇ Machine all over.

∇(B) Bore

∇(T) Turn

∇(P) Plane

∇(D) Drill

∇(G) Grind

Draw an equilateral triangle with sides about $\frac{1}{4}$" long, with one corner of the triangle touching the machined surface, and insert a letter to indicate the type of machining. For surface finish a ground surface is indicated by a number ∇(G) with 36 above.

SCHEDULES AND LABELS

It is the practice on all drawings to have a label in the bottom right-hand corner. These labels may vary considerably in different workshops, according to the information they are required to give, but the student is advised to adopt a label similar to that given on Example 1, page 15. The size of the label will depend on the space available, but need not be more than 5″ × 2½″.

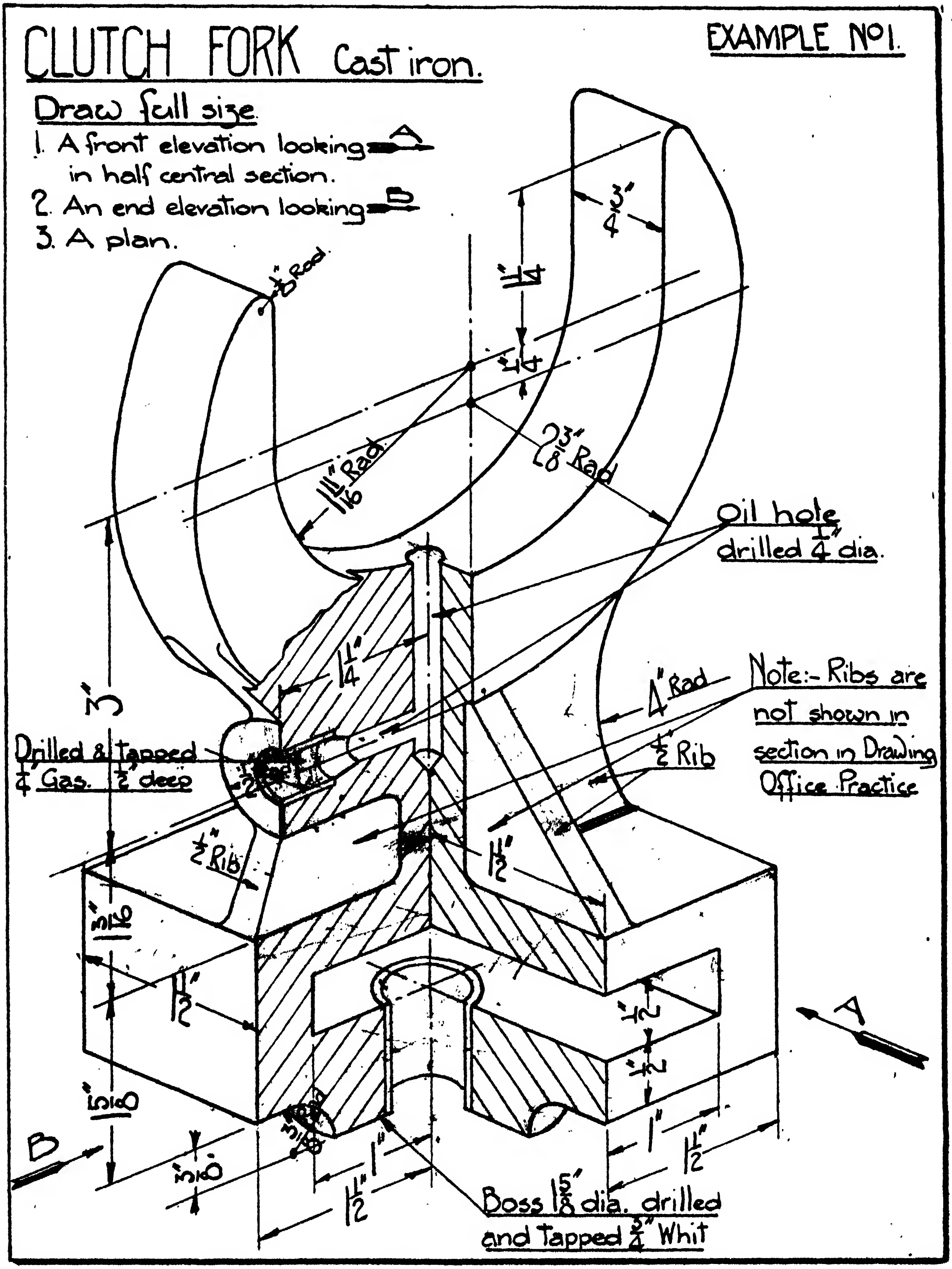
There are several systems of preparing the drawing for the workshop. Some firms prefer to make a separate drawing of each detail, as in Example 1; others make drawings with several details combined, as in Example 2, or with several details drawn separate on one sheet, as in Example 3, together with an assembly drawing.

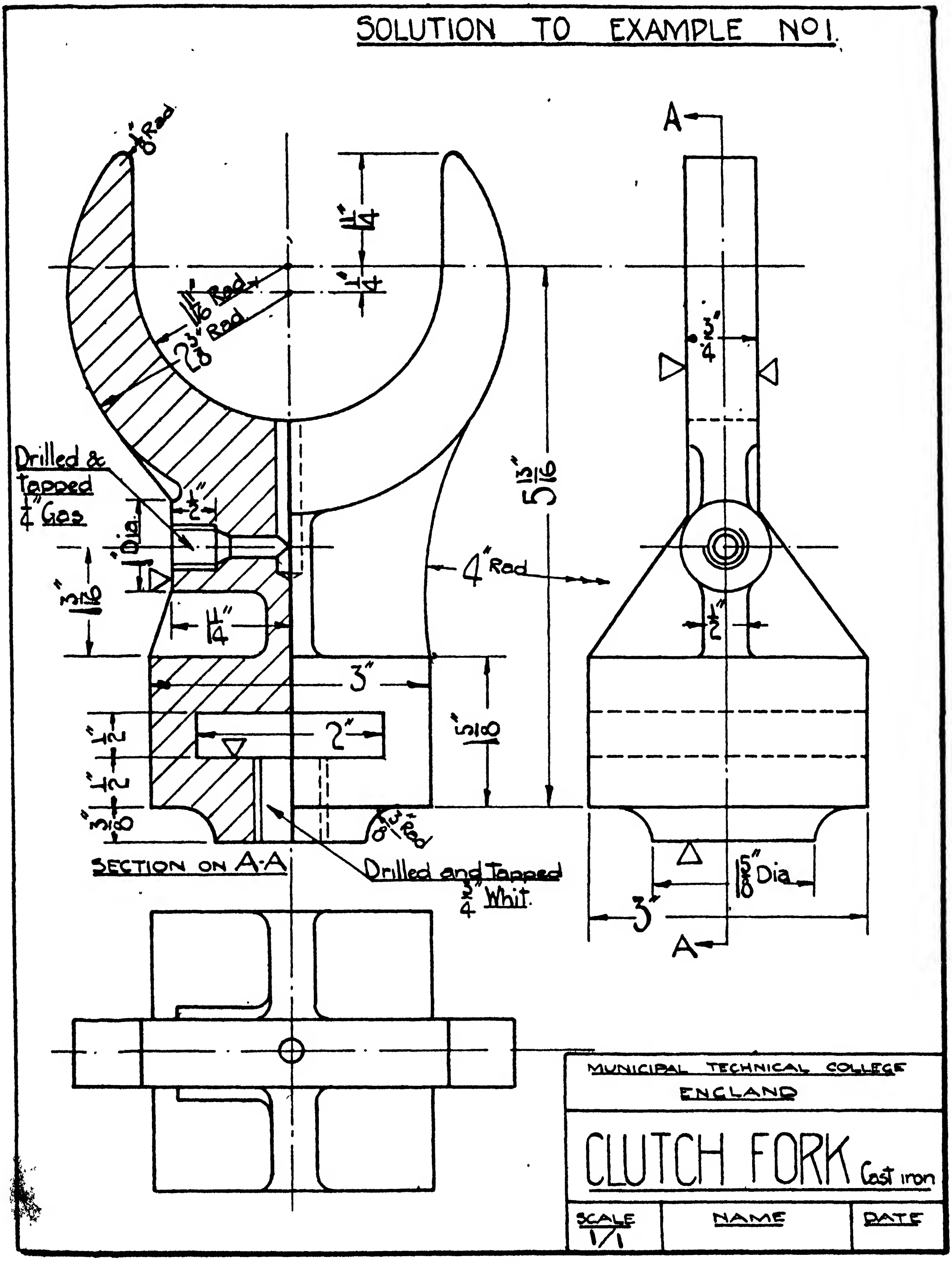
In Examples 2 and 3 a schedule would be required.

The schedule is of great value in every department of the works, including the cost office and other offices, because each part is given a reference letter, and the workmen may book their time employed on the item by reference to the letter, drawing No. and the Order No.

Students are advised to practise making out a schedule on all drawings having several parts, and so acquire facility in stating the materials required for each part.

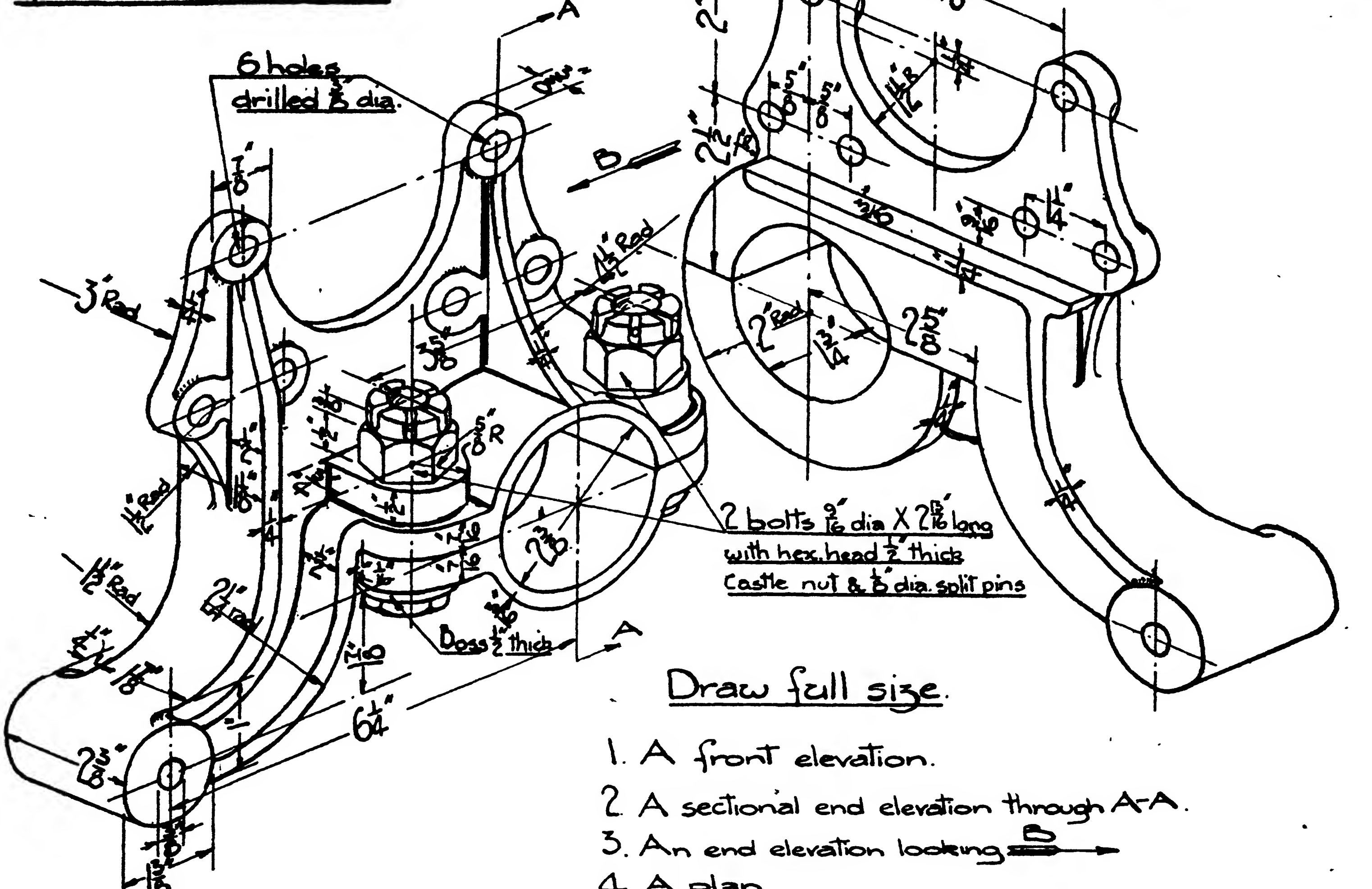
The reference letter should be placed in a circle ½″ diameter, with an arrow pointing to the particular item.


CLUTCH FORK Cast iron.
EXAMPLE No 1.
Draw full size.
1. A front elevation looking A in half central section.
2. An end elevation looking B
3. A plan.
Oil hole drilled 1/4" dia.
Note:- Ribs are not shown in section in Drawing Office Practice
1/4" Rad
1/2" Rib
Drilled & tapped 1/4 Gas. 1/2" deep
Boss 1 5/8" dia. drilled and Tapped 3/4" Whit
2 3/8" Rad
1 11/16" Rad
A
B


SOLUTION TO EXAMPLE No1.
Drilled & Tapped 1/4" Gas
4" Rad
3"
2"
SECTION ON A-A
Drilled and Tapped 3/4" Whit.
A
1 5/8" Dia
3"
A
MUNICIPAL TECHNICAL COLLEGE
ENGLAND
CLUTCH FORK Cast iron
SCALE 1/1
NAME
DATE

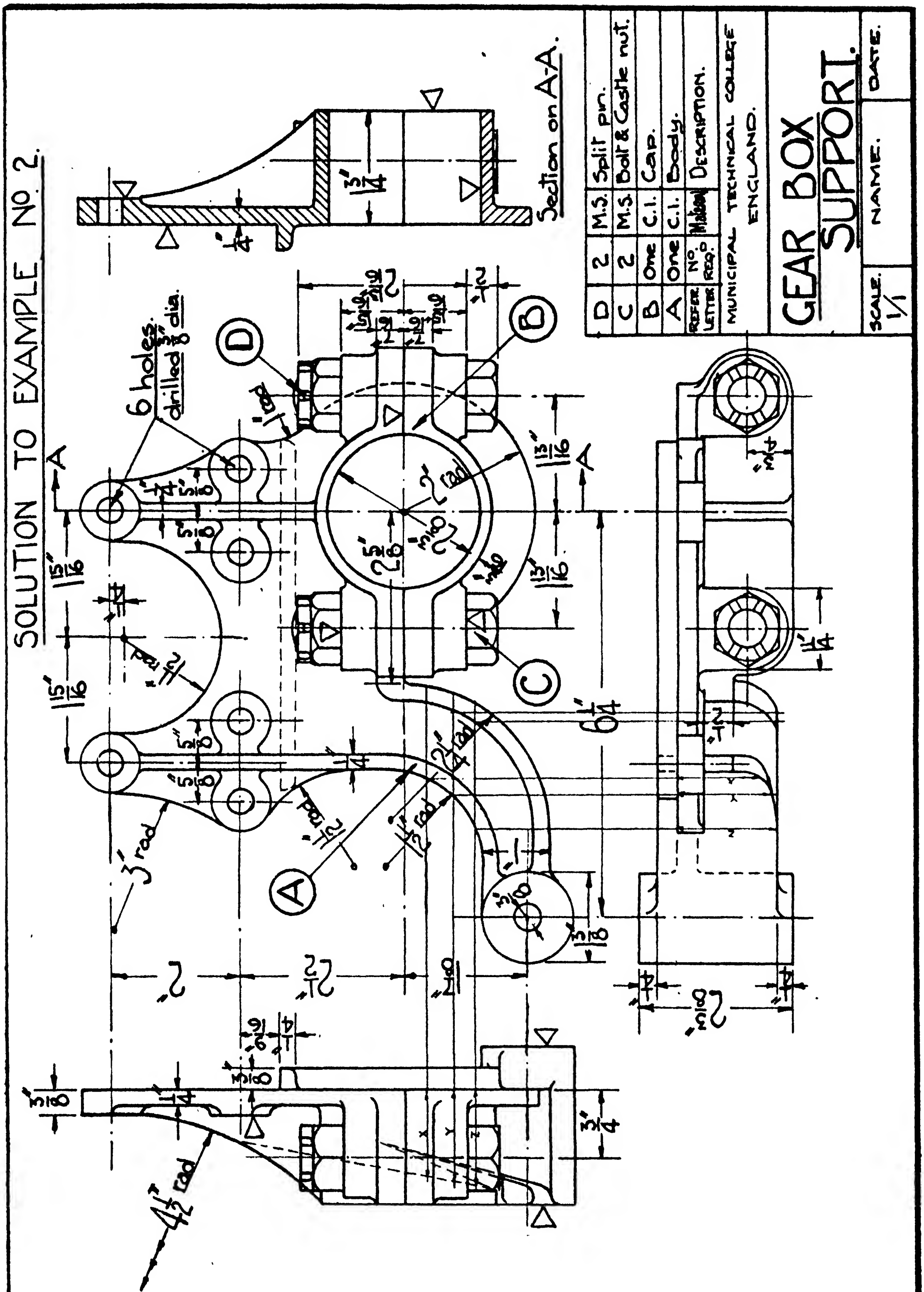
GEAR BOX SUPPORT

EXAMPLE Nº 2.



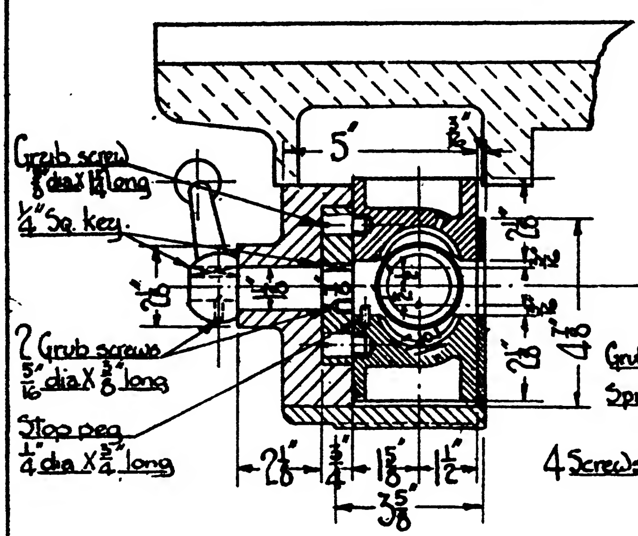
Draw full size.

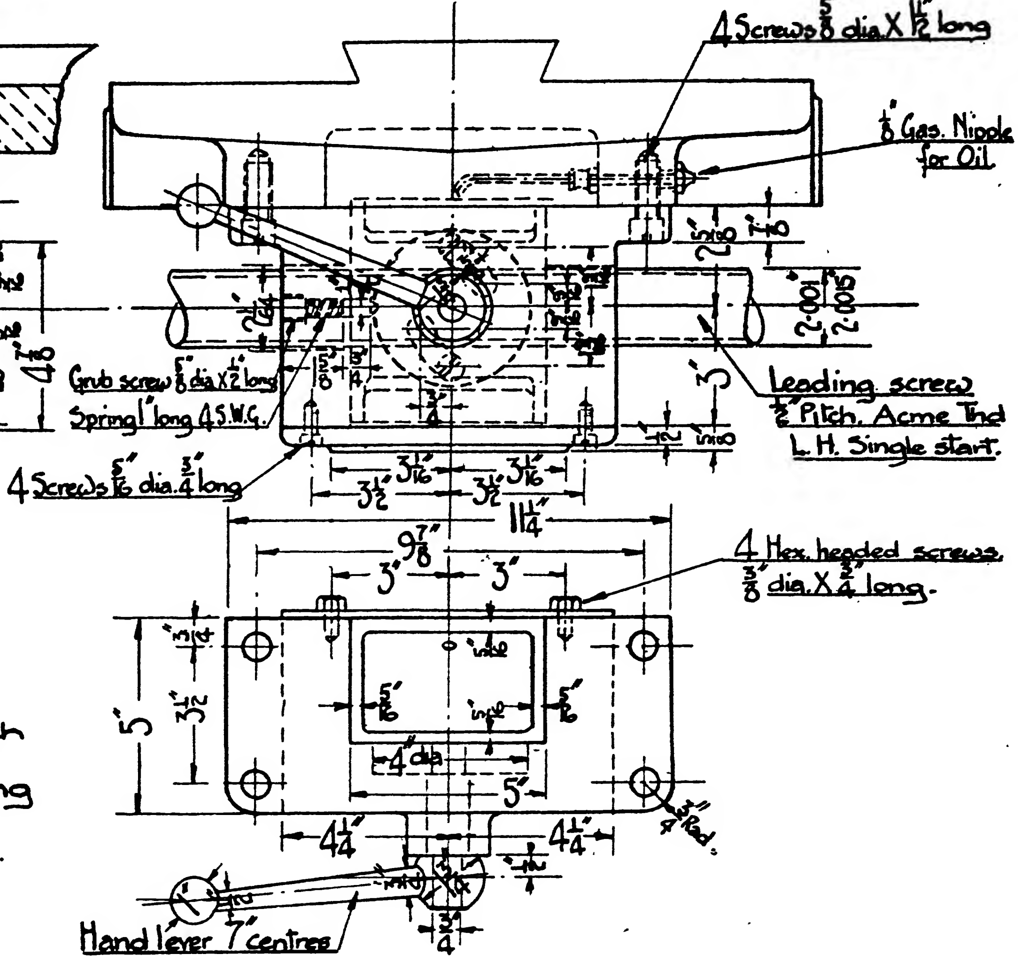
1. A front elevation.
2. A sectional end elevation through A-A.
3. An end elevation looking B ⟶
4. A plan


SOLUTION TO EXAMPLE No. 2.
Section on A-A.
6 holes drilled 3/8" dia.
D 2 M.S. Split pin.
C 2 M.S. Bolt & Castle nut.
B One C.I. Cap.
A One C.I. Body.
REFER. LETTER No. REQ'D Material DESCRIPTION.
MUNICIPAL TECHNICAL COLLEGE ENGLAND.
GEAR BOX SUPPORT.
SCALE. 1/1
NAME.
DATE.

NUT BOX for Lathe.

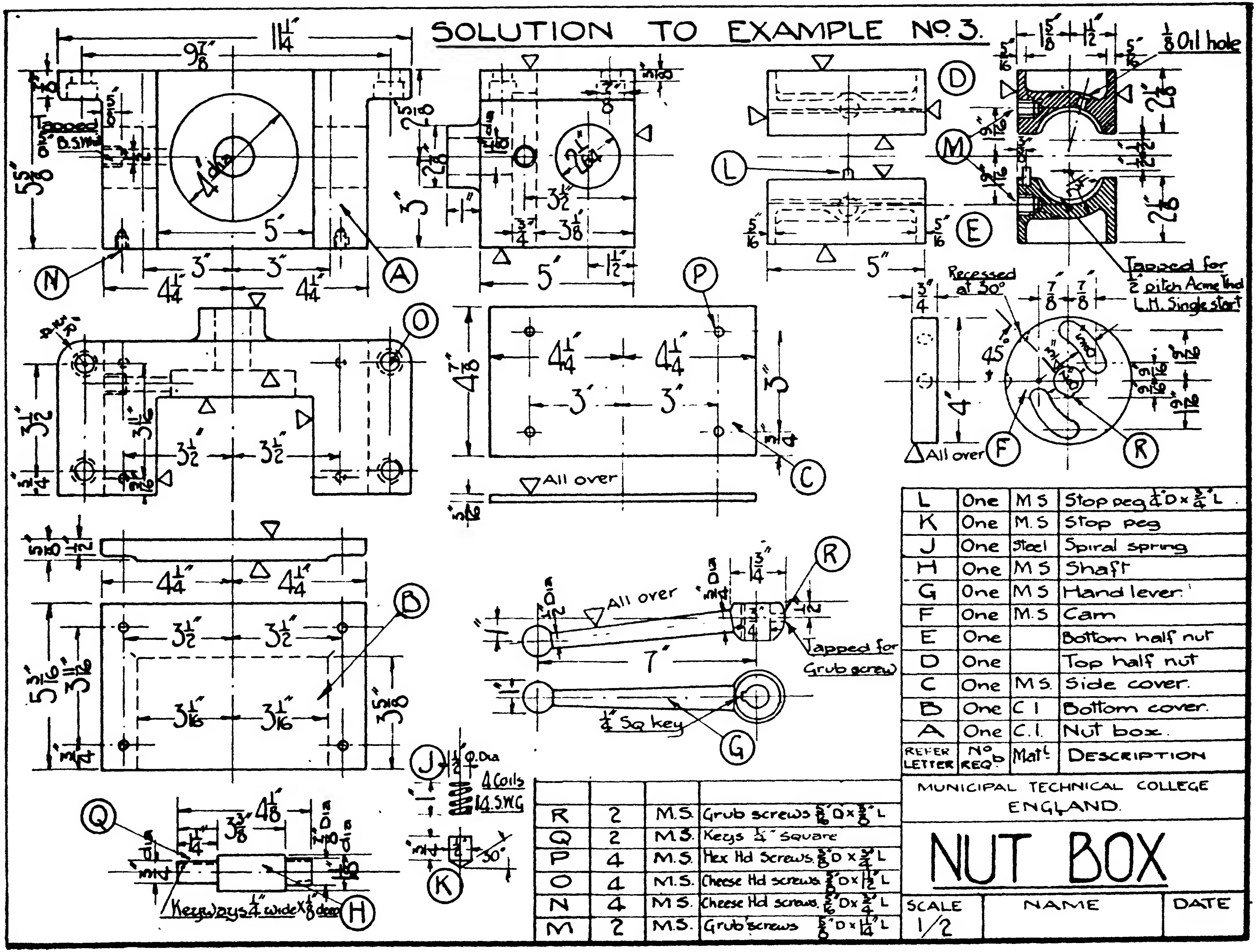
EXAMPLE No. 3.





Draw 6" - 1 foot.

Sufficient views of each detail to make a drawing suitable for a workshop.


SOLUTION TO EXAMPLE No. 3.
1/8 Oil hole
Tapped for 1/2" pitch Acme Thd L.H. Single start
Recessed at 30°
All over
Tapped 5/16 B.S.W.
Tapped for Grub screw
1/4" Sq key
Keeyways 1/4" wide × 1/8" deep
4 Coils 14 S.W.G.
L One M.S. Stop peg 1/4"D × 3/4"L
K One M.S. Stop peg
J One Steel Spiral spring
H One M.S. Shaft
G One M.S. Hand lever
F One M.S. Cam
E One Bottom half nut
D One Top half nut
C One M.S. Side cover
B One C.I. Bottom cover
A One C.I. Nut box
REFER LETTER No. REQD. Mat'l DESCRIPTION
R 2 M.S. Grub screws 5/16"D × 3/8"L
Q 2 M.S. Keys 1/4" square
P 4 M.S. Hex Hd Screws 3/8"D × 3/4"L
O 4 M.S. Cheese Hd screws 5/8"D × 1 1/2"L
N 4 M.S. Cheese Hd screws 5/16"D × 3/4"L
M 2 M.S. Grub screws 5/8"D × 1 1/4"L
MUNICIPAL TECHNICAL COLLEGE ENGLAND
NUT BOX
SCALE 1/2
NAME
DATE

CURVES OF INTERSECTION

The line of interpenetration due to the intersection of two solids is determined by geometrical construction.

The method of construction for simple pipe intersection is shown in Figs. 1, 2, 3, and 4.

Fig. 1 shows a branch pipe meeting the main pipe at right angles. The pipes in this case are of equal diameters. Draw the elevation and the plan as shown, and construct a semi-circle on the branch pipe in the plan and the elevation. Divide the semi-circle into, say, six equal parts with either compasses or 60-degree set-square, and mark *A*, *B*, *C*, and *D* on each view. Project horizontal lines from each letter on the plan to A^1, B^1, C^1, and D^1, and project from the plan to the elevation to meet the horizontal projectors at A^2, B^2, C^2, and D^2. The line of intersection is obtained by drawing through these points, and in this case it would be a straight line.

Figs. 2, 3 and 4 may be constructed in a similar manner.

> NOTE.—When pipes having the same diameter intersect, whether at right angles or any other angle, the resulting line of intersection will be a straight line, as shown in Fig. 3.

The usual practice in a drawing office, when showing intersection lines, is to fix the point D^2 (see Fig. 2) by projecting from a point D^1 on the plan, and then, using compasses set to a suitable radius "*M*", to join the points A^2 and D^2. Of course, this is not quite accurate, but is all that is required on most workshop drawings.

Fig. 5 shows the curve that may be developed on a connecting rod by the following method:—

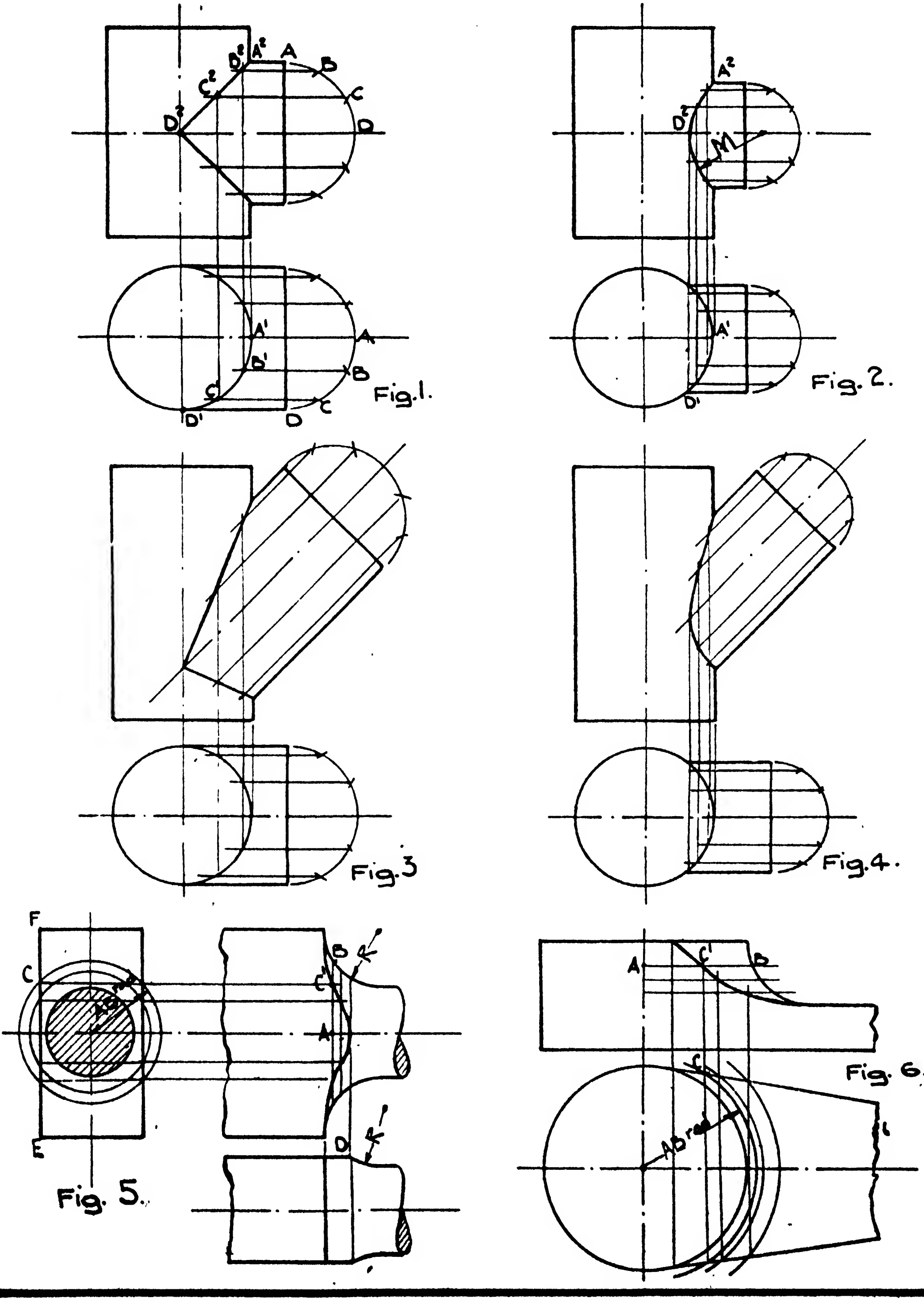
The diagram on page 21, Fig. 5, shows three views of a part of a connecting-rod end. Divide the curved portion, where the round rod joins the rectangular part, into several slices from about $\frac{1}{8}''$ to $\frac{1}{4}''$ apart. With a radius of *A–B* draw an arc on the end elevation, to cut *EF* at *C*. Project the point *C* back on to the line *A–B* to C^1, and this will give one point of the required curve. Similar points may be obtained by taking several radii.

Note that the plan shows where the curve or fillet finishes on the plan at *D*.

Fig. 6 shows the curve that occurs on cranks, levers, and some shaft brackets.

The construction is the same as in Fig. 5, but it is usual in drawing-office practice to use the same radius for both curves.

CURVES OF INTERSECTION.



STRUCTURES

Steel structures are rolled to standard shapes, and are used to construct buildings, bridges, boilers, tanks, conveyors, gasholders, frames, cranes, etc.

Examples of various common sections are shown on page 23.

The standard sizes may be obtained from the handbooks published by the leading manufacturers.

Fig. 1 shows a rolled steel joist (R.S.J.), sometimes called a girder of " *H* " section.

Fig. 2 shows a channel.

When joists and channels are used in a horizontal position, and subject to flexure, they are referred to as beams, but when used in a vertical position, they may be referred to as columns, stanchions or struts.

Figs. 3 and 4 show an equal and an unequal angle respectively.

Fig. 5 shows a tee.

In addition to the above sections, flat bars, round bars, (black or bright), half-round bars, square bars, and hexagon bars may be obtained to standard sizes, in addition to sheet steel of various sizes.

Stiffeners may be made from angles and tees by shearing out pieces at 90 degrees, and then bending and welding, as shown in Fig. 6.

Rivets have been standardized by the British Standards Institution, and several of the simplest types are given, with proportions for use in the drawing examples.

STRUCTURE DETAILS.

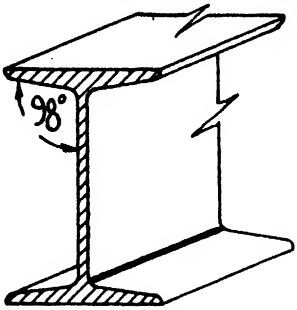


Fig 1.

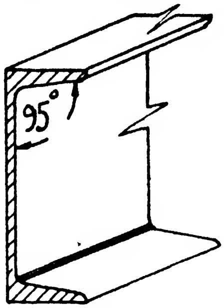


Fig. 2.

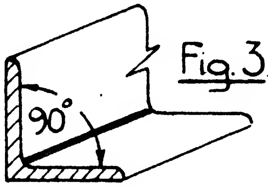


Fig. 3.

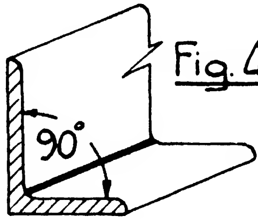
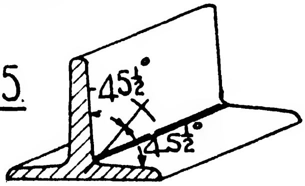


Fig. 4.

Fig 5.



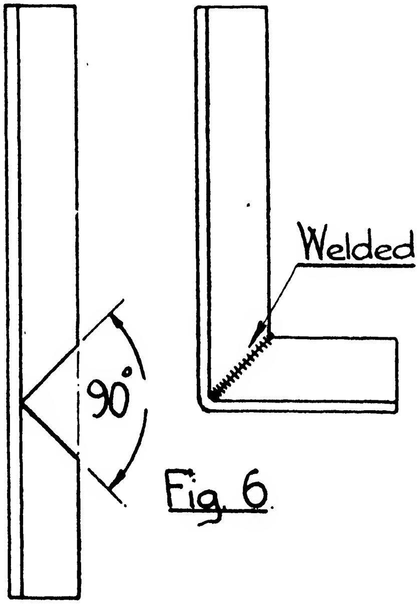
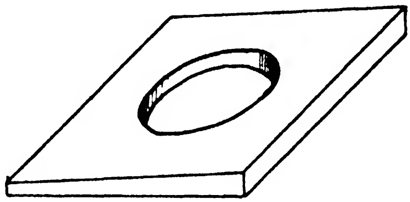
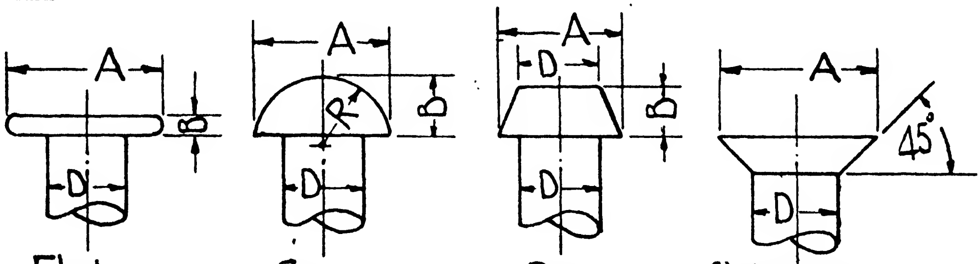


Fig. 6.



Square taper washer, made to suit angle of section



Flat	Snap	Pan.	C's'k (countersunk)
A = 2D.	A - 1·75D.	A - 1·6D.	A - 2D
B - ·25D.	B - ·75D.	B ·7D.	B - ·5D
	R - ·885D.		

GEARS

There are three recognised methods of specifying the pitch of gear teeth:—

(*a*) Circular or arc pitch [P_a], measured from one point on the tooth to a similar point on the next tooth on the pitch circle, as shown in Figs. 1 and 2.

(*b*) Diametral pitch [DP], the ratio of the number of the teeth "N" to the pitch circle diameter $P.C.D.$;

or $$DP = \frac{N}{P.C.D.}; \text{ also } DP = \frac{\pi}{P_a}.$$

(*c*) Module [m], the ratio of the pitch-circle diameter to the number of teeth;

or $$m = \frac{P.C.D.}{N}; \text{ also } m = \frac{1}{DP}, \text{ and } m = \frac{P_a}{\pi}.$$

The outside diameter OD of a gear wheel may be obtained by the formula

$$OD = \frac{N+2}{DP}.$$

There are two geometrical curves that give correct velocity ratio for gear teeth: (*a*) Cycloidal, (*b*) Involute.

Fig. 1 shows the proportions for cycloidal teeth, and an approximate method of showing the shape of the teeth on a working drawing by using the radii X and Y from the centre of each tooth, but the true shape must be obtained by geometrical construction.

Fig. 2 shows the profile of involute teeth, with the approximate method of drawing the shape of the tooth with a radius "Z".

The profile of involute teeth is obtained by geometrical construction. The curve is developed on a base circle, as shown in Fig. 4. Draw the pitch circle diameter, and from a point O draw a line at an angle θ.

This angle is called the pressure angle, and varies from 14½ degrees to 22 degrees. The British Standards angle is 20 degrees. Draw a line at right angles to the pressure angle, and the radius of the base circle is M.

Fig. 3 shows the names of the various parts of gear teeth.

When setting out a pair of bevel wheels, it is necessary to draw the two cones in contact, as shown in Fig. 5.

In some drawing-offices this is all that is given on a working drawing, together with the particulars of teeth, etc.

In Fig. 6 the teeth are shown drawn on the cones by setting off the sizes of the addendum and the dedendum A and B of the teeth from the formula given below.

Tooth proportions of standard teeth:—

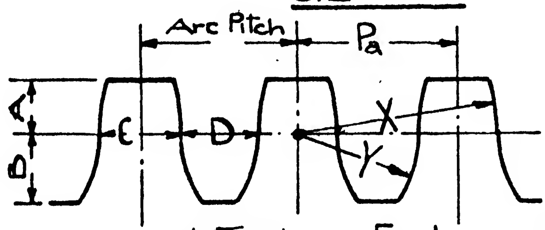
$$\text{Addendum} = \frac{1}{DP} = 0{\cdot}3183\,P_a. \qquad \text{Dedendum} = \frac{1\frac{1}{4}}{DP} = 0{\cdot}3979\,P_a.$$

Therefore the clearance at the bottom of the teeth is

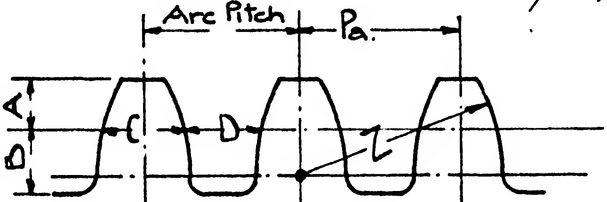
$$\frac{\frac{1}{4}}{DP} = 0{\cdot}0796\,P_a.$$

Fig. 7 shows the complete section of the bevel wheels as is required on Sheet No. 21 B.

GEARS.



Cycloidal Teeth Fig. 1.



Involute teeth Fig. 2.

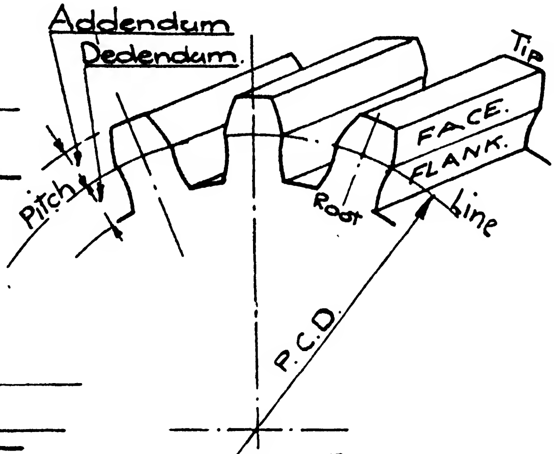


Fig. 3.

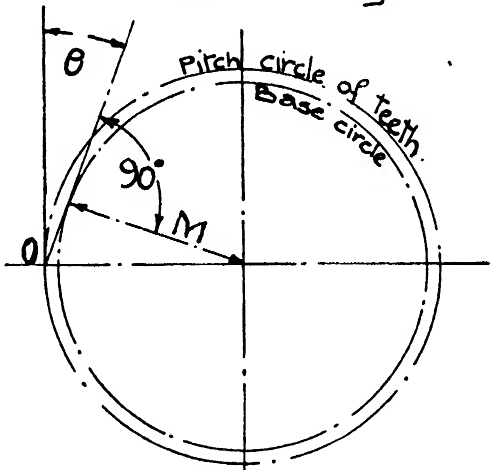


Fig. 4.

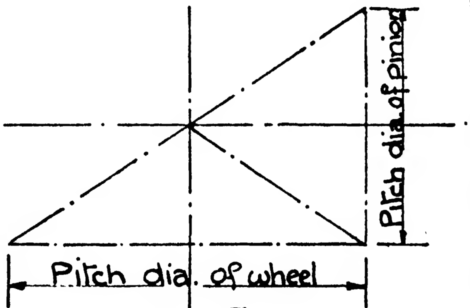


Fig. 5.

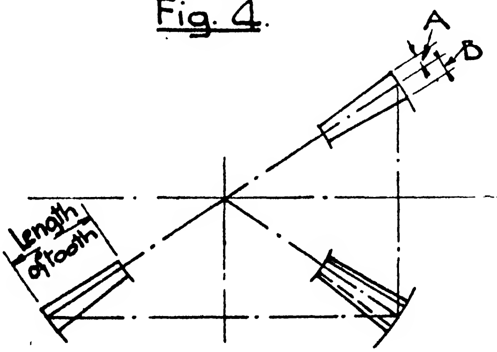


Fig. 6.

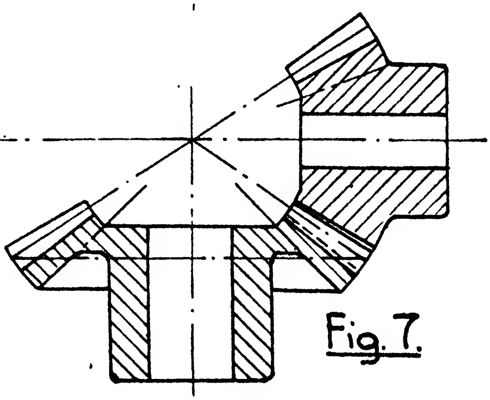
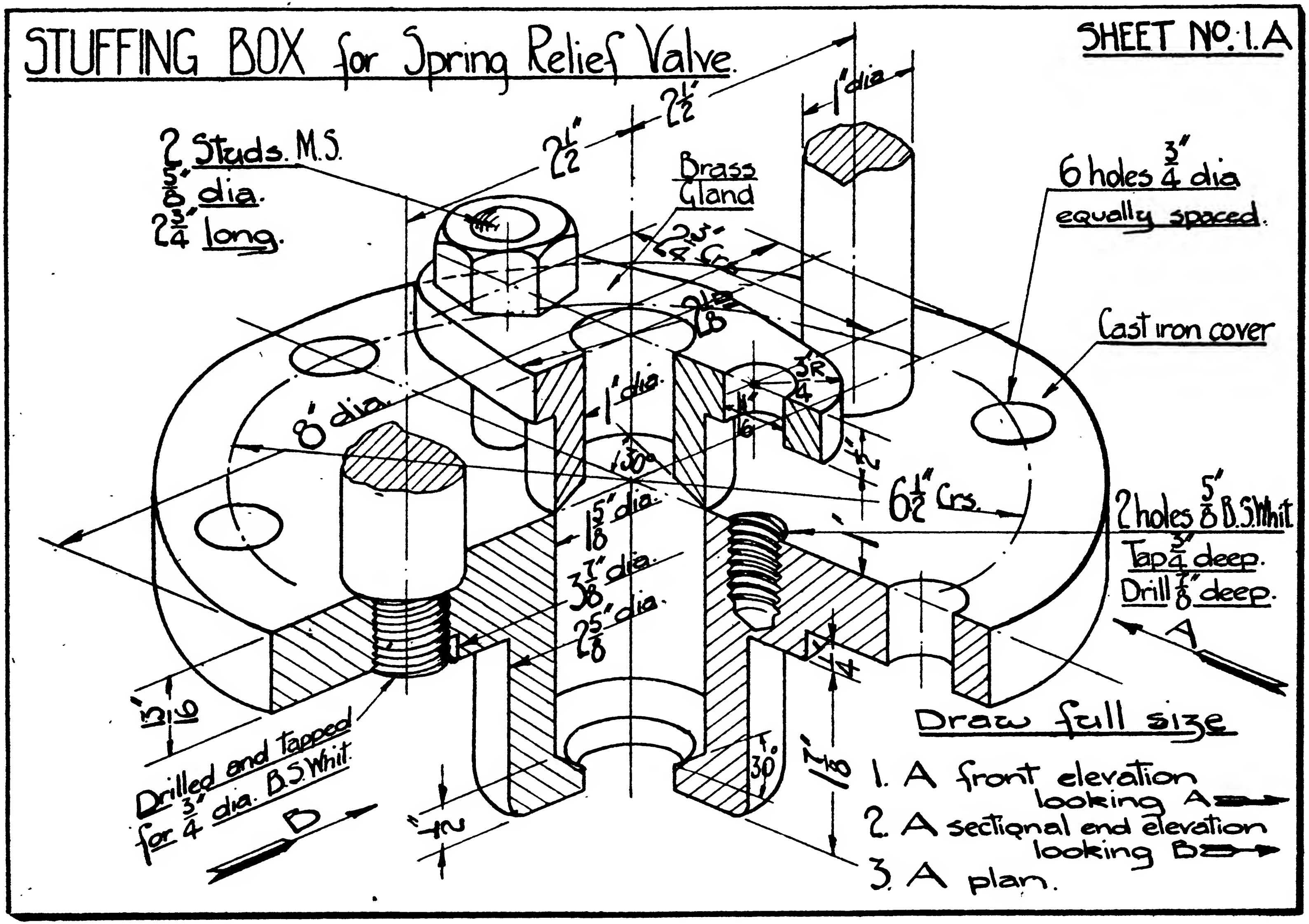


Fig. 7.

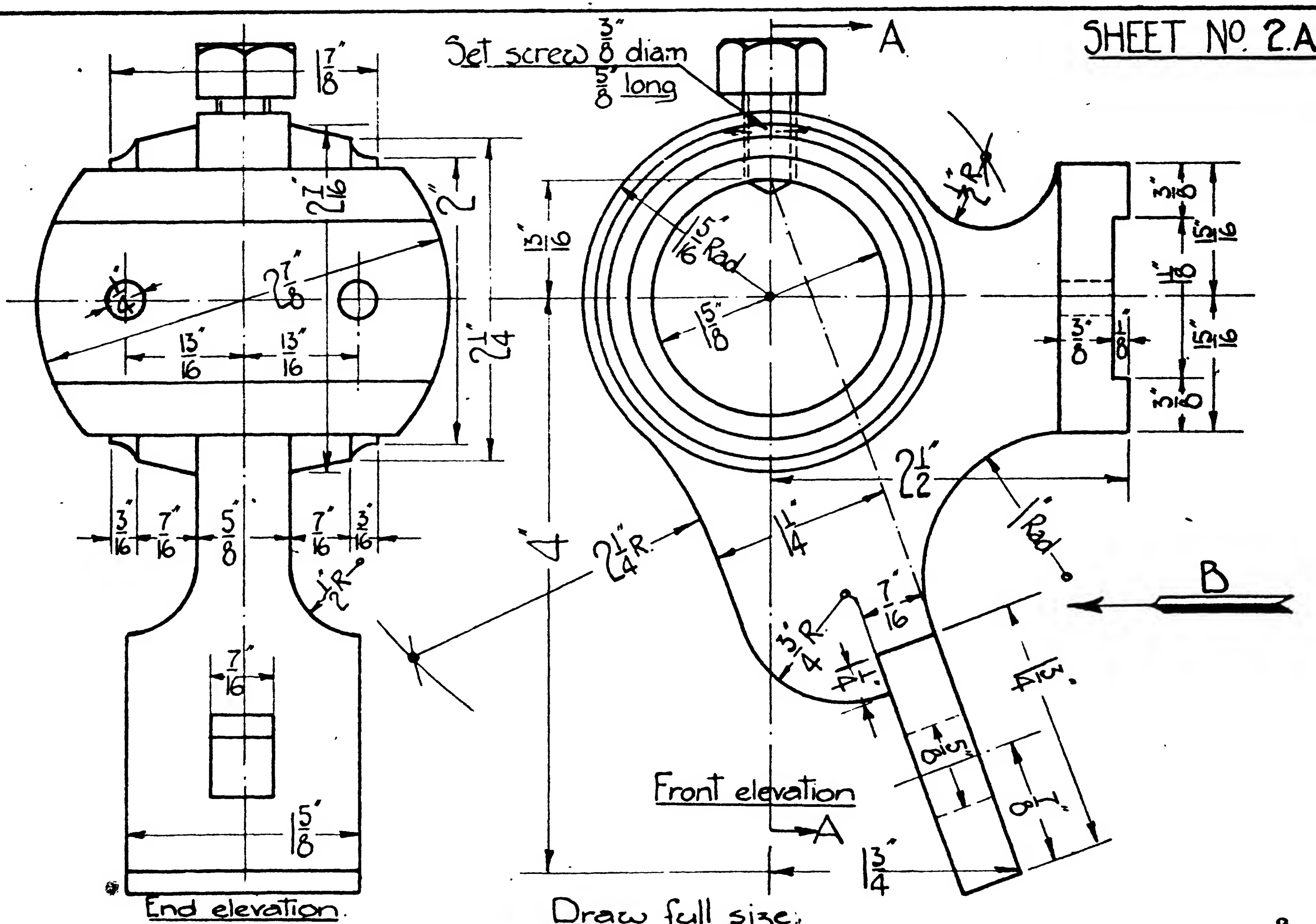
LIST OF EXAMPLES

LIST OF EXAMPLES



STUFFING BOX for Spring Relief Valve.
SHEET No. 1.A
2 Studs. M.S.
5/8" dia.
2 3/4" long.
2 1/2"
2 1/2"
1" dia
Brass Gland
2 3/4" Crs
2 1/8"
6 holes 3/4" dia
equally spaced.
Cast iron cover
1" dia.
3/4 R
1/16
8" dia.
130°
6 1/2" Crs.
1 5/8" dia.
3 7/8" dia.
2 5/8" dia.
2 holes 5/8" B.S.Whit.
Tap 3/4" deep.
Drill 7/8" deep.
A
1/4
Drawn full size
3/16
Drilled and Tapped for 3/4" dia. B.S.Whit.
B
30°
1. A front elevation looking A
2. A sectional end elevation looking B
3. A plan.

SHEET No. 2.A



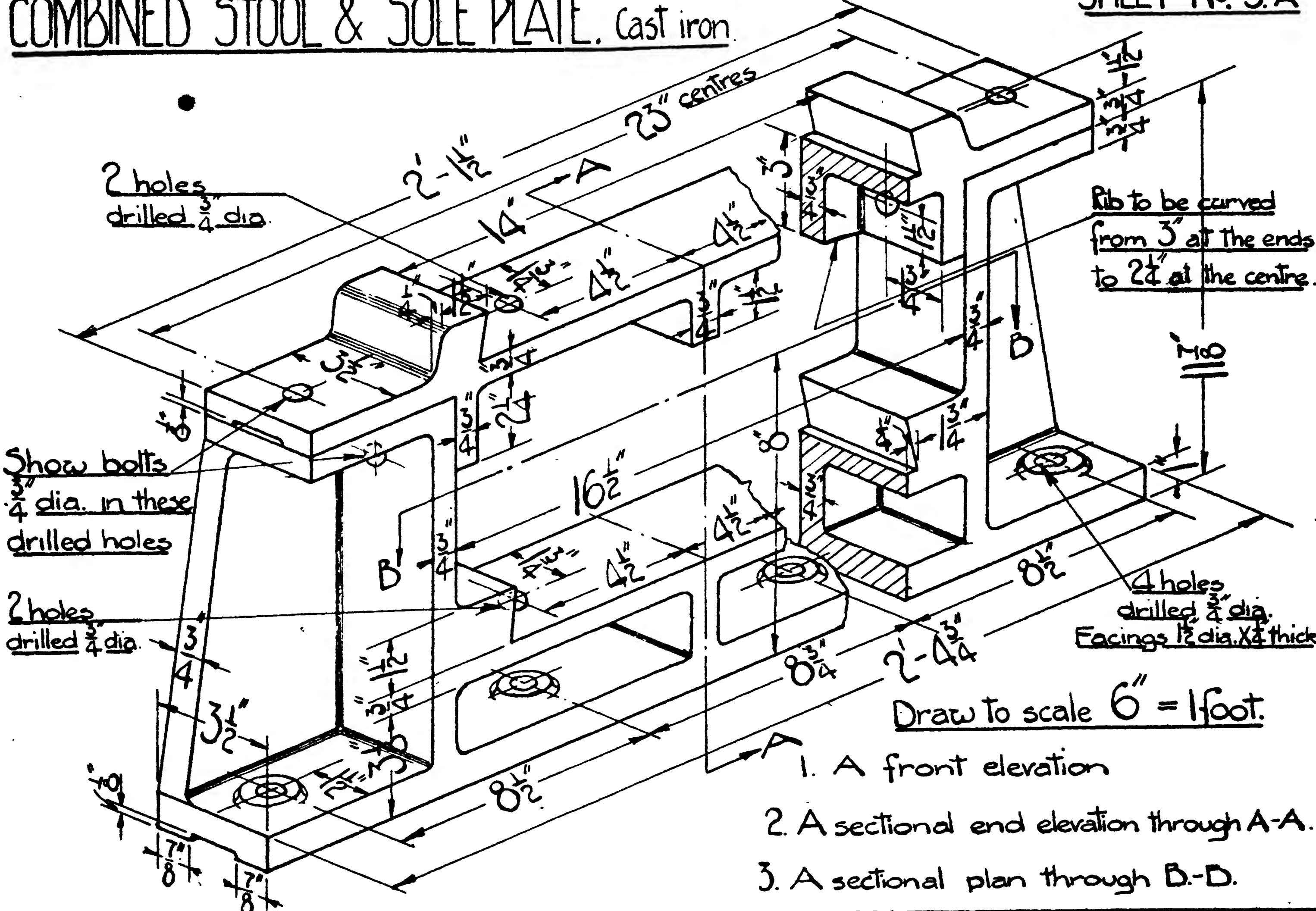
HINGE BRACKET cast iron

Draw full size.

1. A front elevation.
2. An end elevation looking B →
3. A sectional end elevation through A-A.
4. A plan.

COMBINED STOOL & SOLE PLATE. Cast iron

SHEET No. 3. A

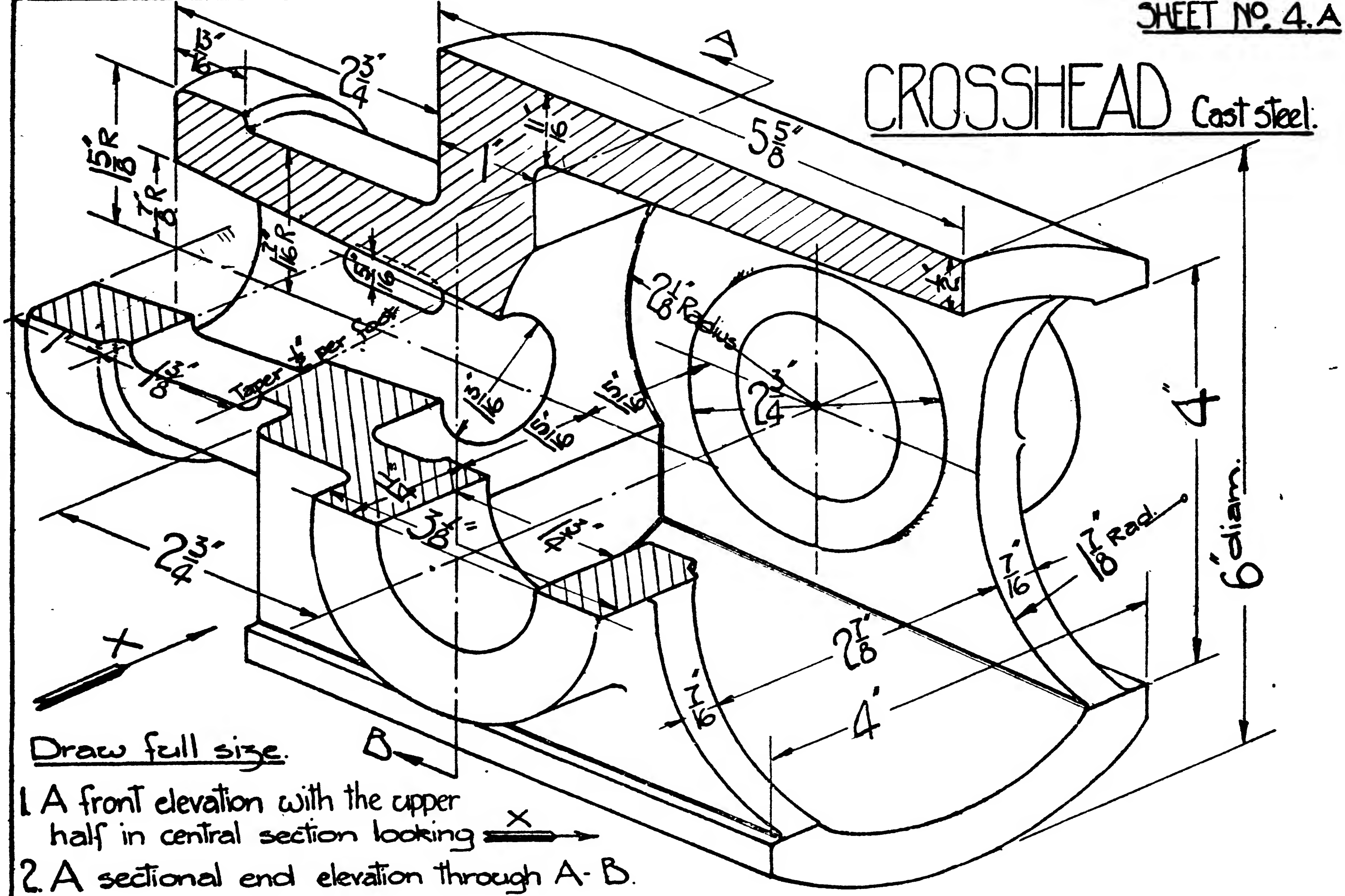


Draw to scale 6" = 1 foot.

1. A front elevation
2. A sectional end elevation through A-A.
3. A sectional plan through B.-D.

SHEET No. 4.A

CROSSHEAD Cast steel.

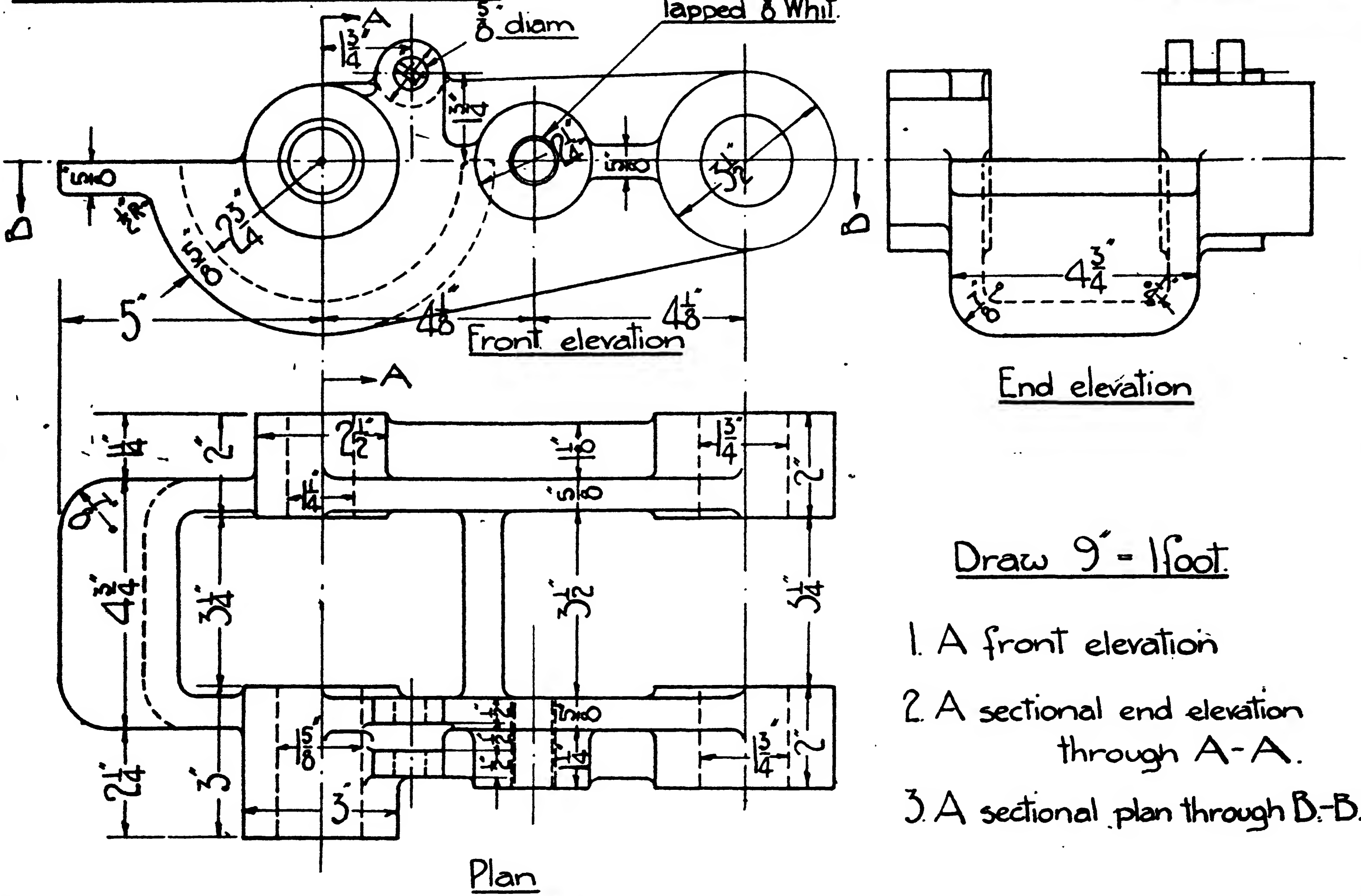


Draw full size.

1. A front elevation with the upper half in central section looking X
2. A sectional end elevation through A-B.
3. A plan in half central section

SWING BRACKET cast iron

SHEET No. 5A

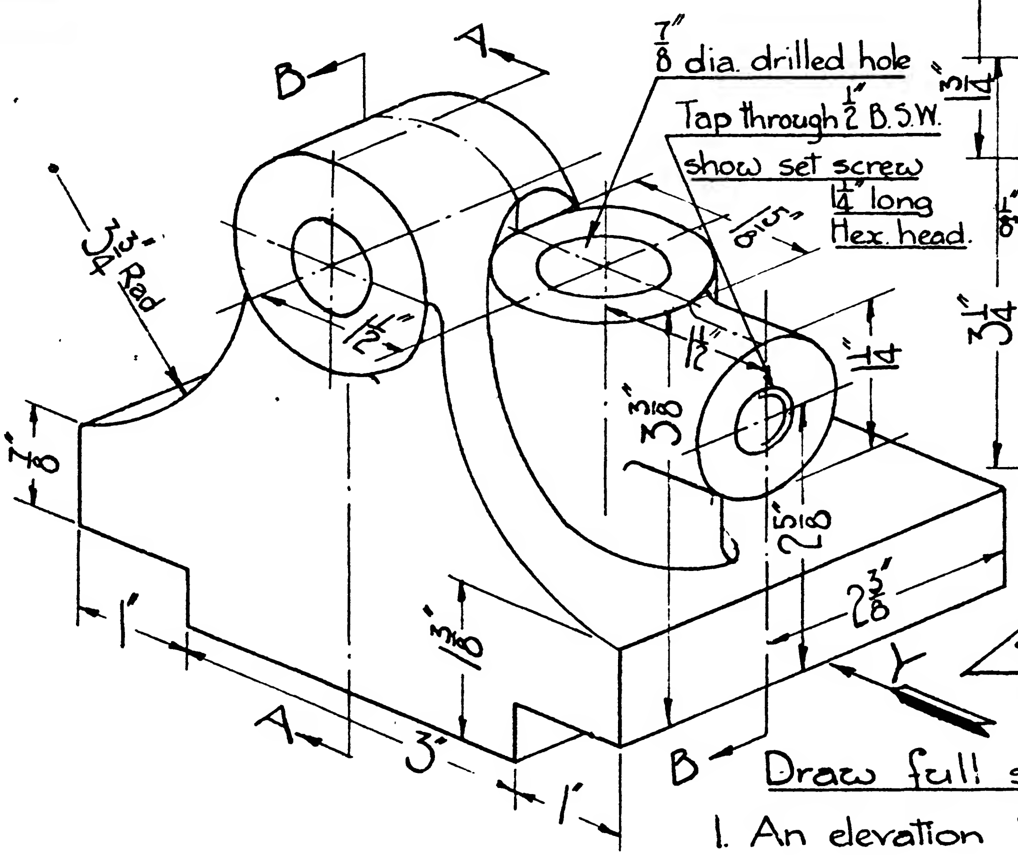


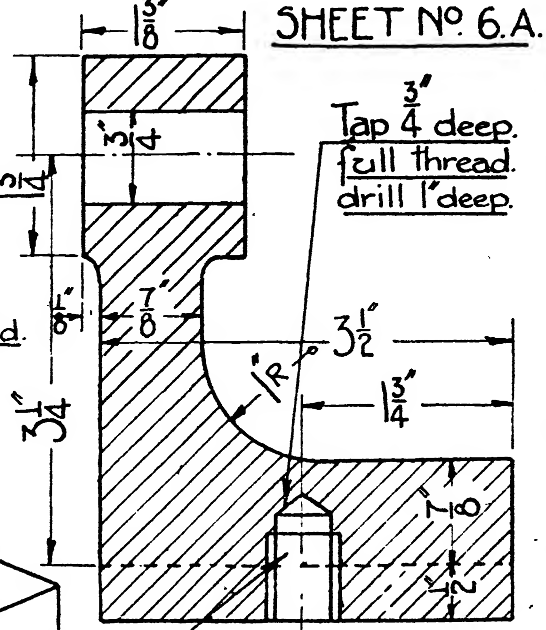
Draw 9" = 1 foot.

1. A front elevation
2. A sectional end elevation through A-A.
3. A sectional plan through B-B.

LATHE BRACKET cast iron.

SHEET No. 6.A.



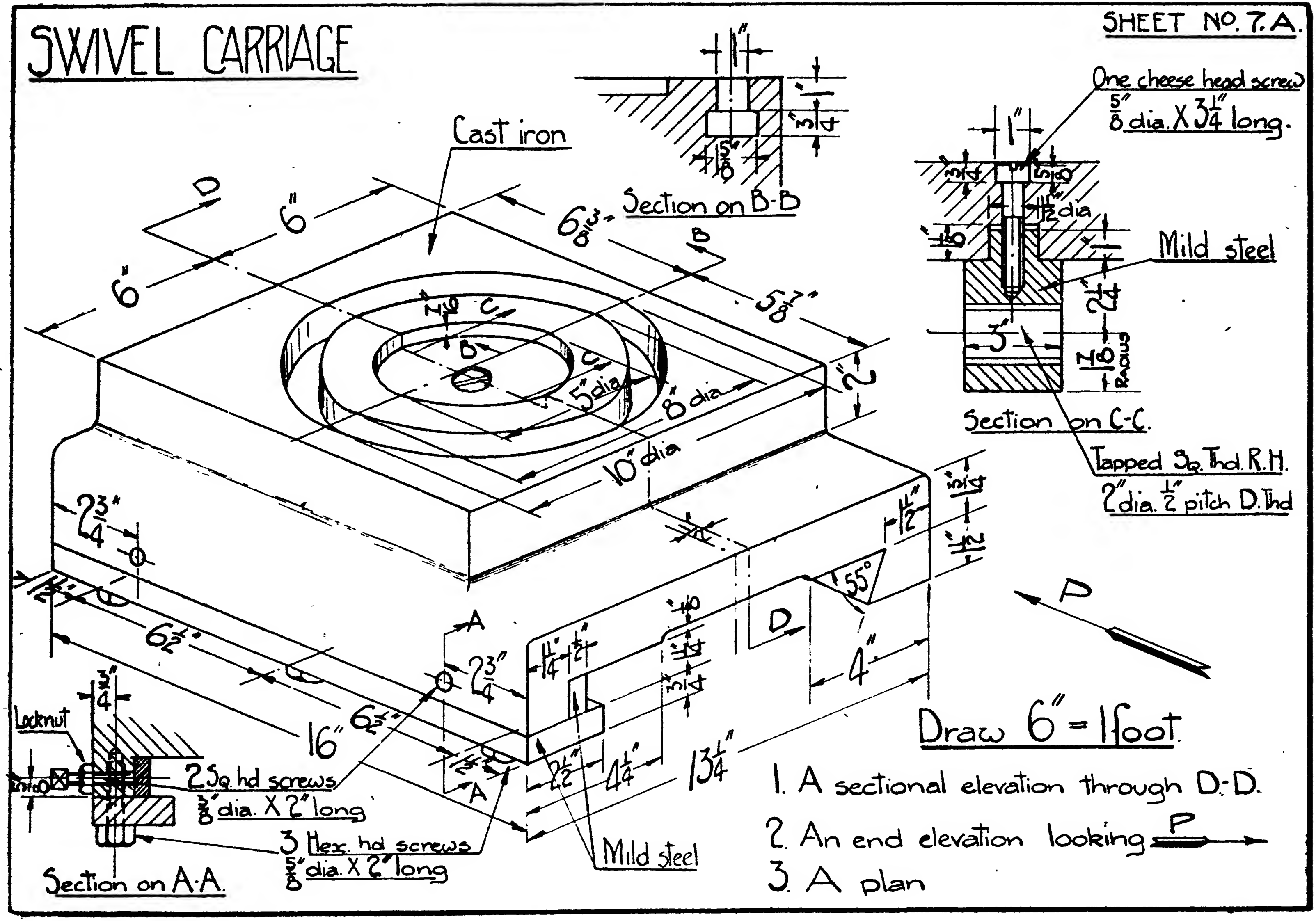


Section A-A

Show $\frac{5}{8}''$ dia. stud and nut.
Stud to protrude $2\frac{1}{2}''$

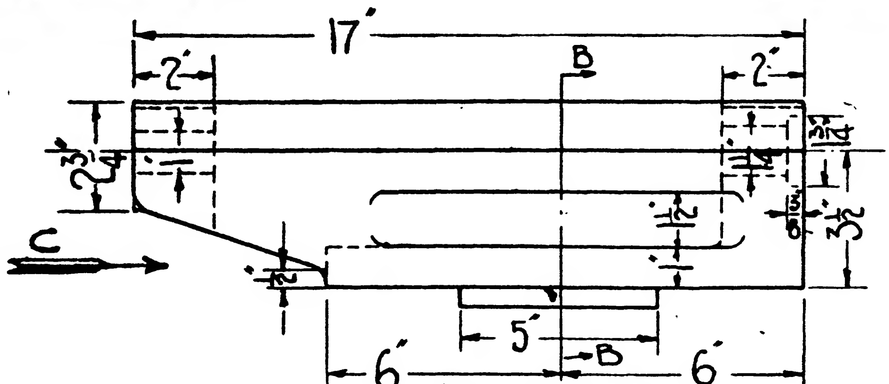
Draw full size

1. An elevation looking → Y
2. A sectional end elevation through B.-B.
3. A plan.

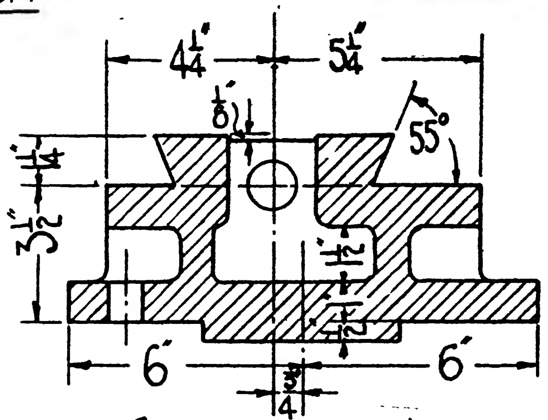

SWIVEL CARRIAGE
SHEET No. 7.A.
Cast iron
Section on B-B
One cheese head screw
5/8" dia. X 3 1/4" long.
Mild steel
Section on C-C.
Tapped Sq. Thd. R.H.
2" dia. 1/2" pitch D. Thd
10" dia
8" dia
5" dia
Locknut
2 Sq. hd screws
3/8" dia. X 2" long
3 Hex. hd screws
5/8" dia. X 2" long
Section on A-A.
Mild steel
Draw 6" = 1 foot.
1. A sectional elevation through D-D.
2. An end elevation looking P
3. A plan

CROSS SLIDE for a 25" centre lathe. Cast iron

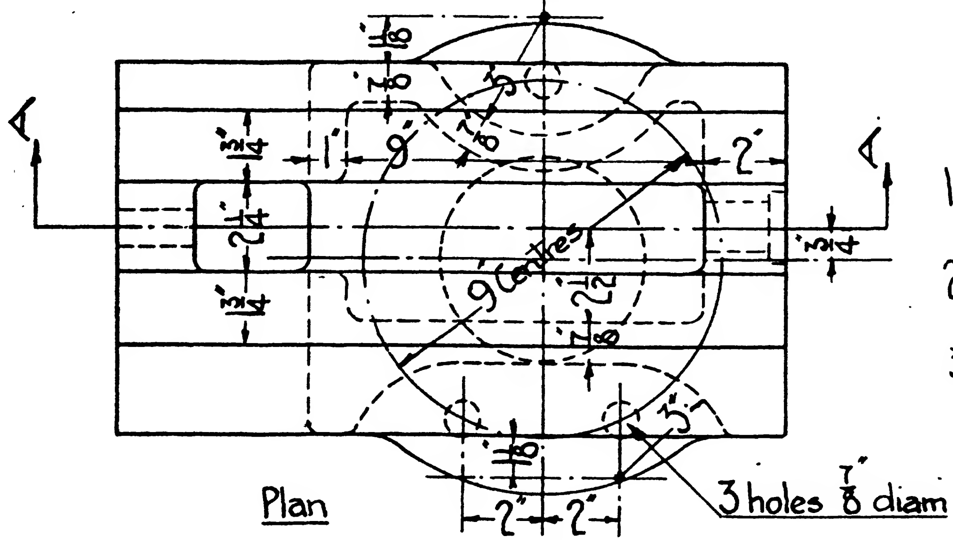
SHEET No. 8 A.



Front elevation



Sectional end elevation through B-B



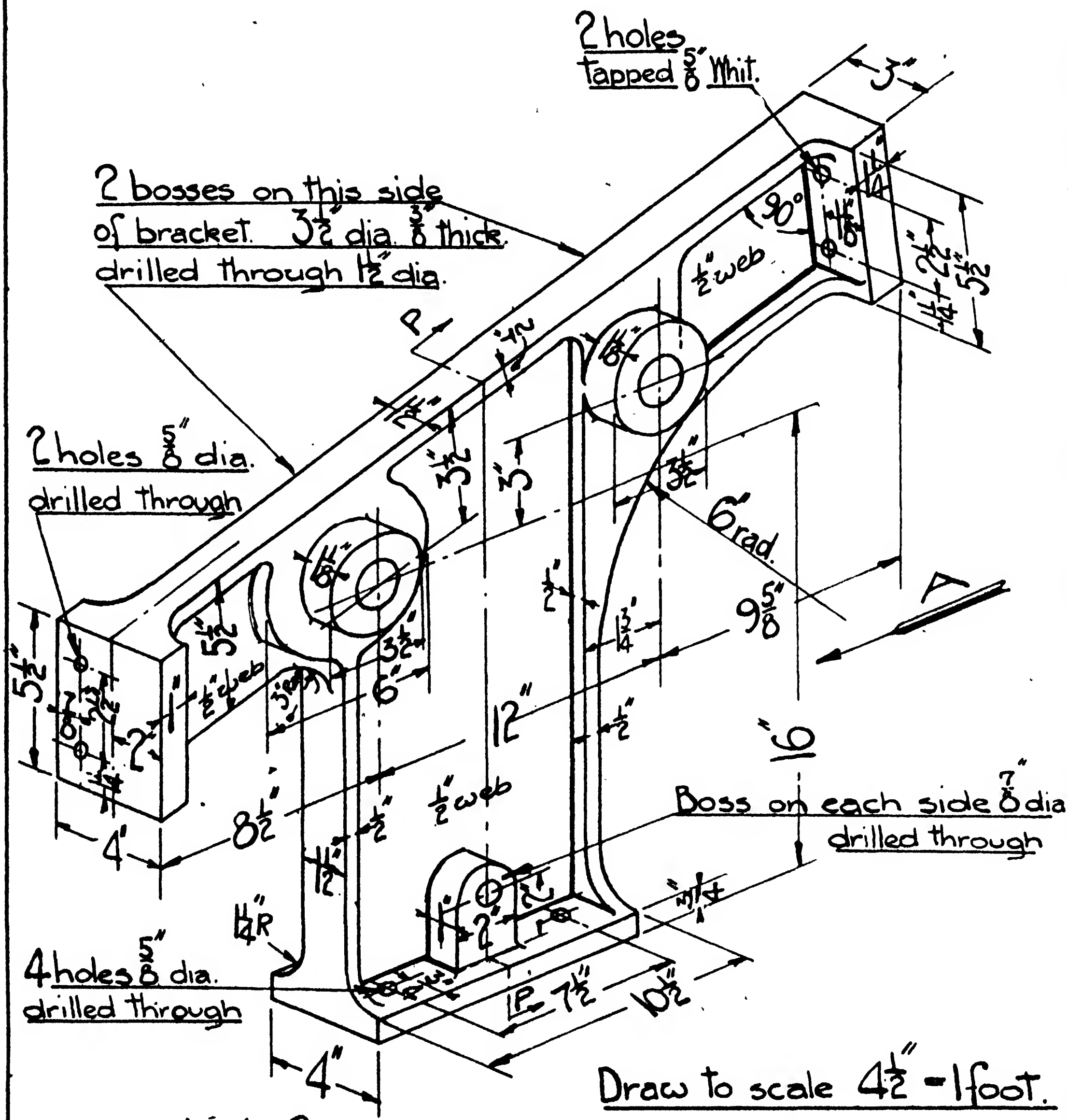
Plan

Draw to scale of 6" = 1 foot

1. A sectional front elevation through A A
2. An end elevation looking ⟹ C
3. A plan.

CONVEYOR BRACKET cast iron.

SHEET No. 9.A.

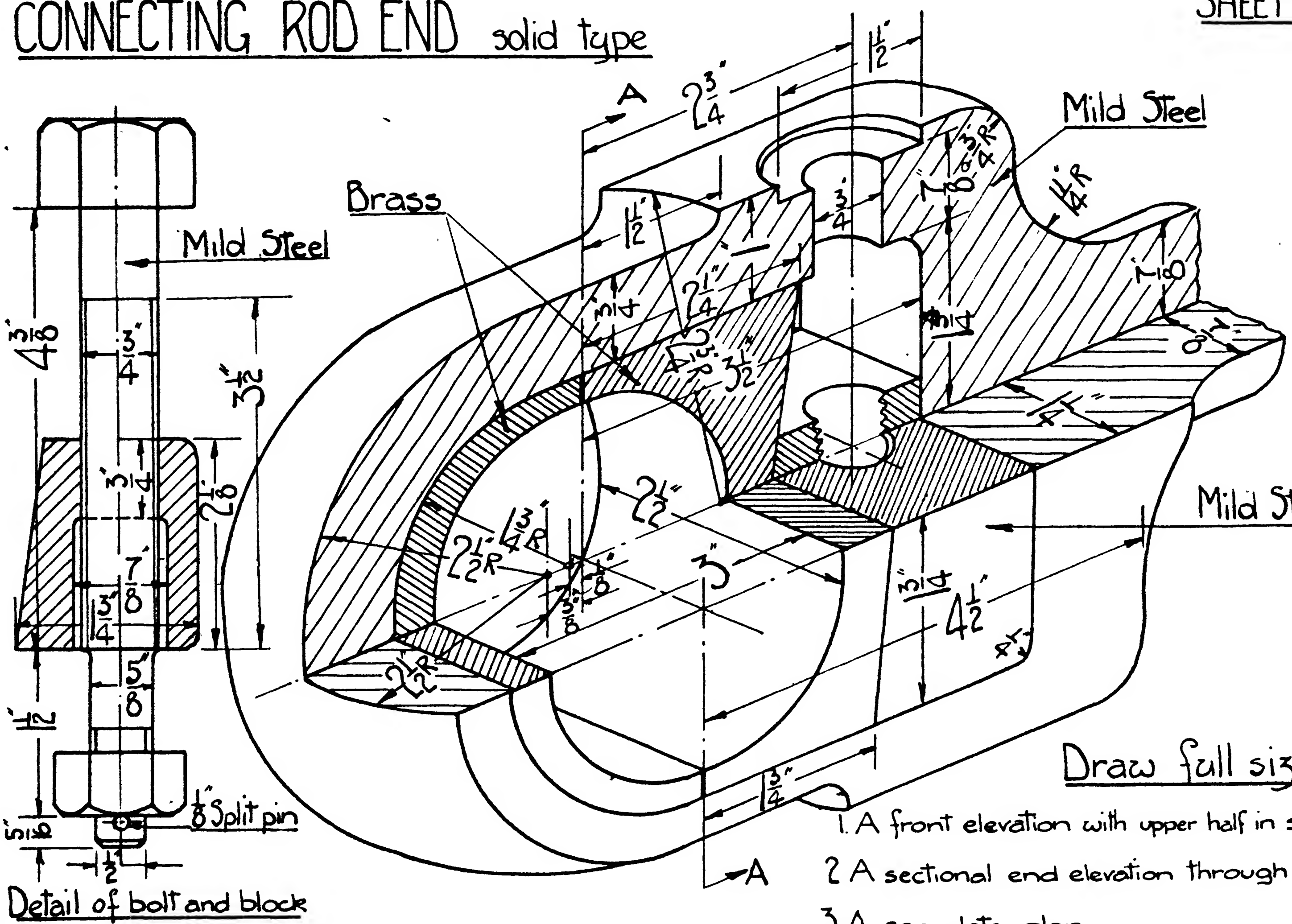


Draw to scale 4½" - 1 foot.

1. A front elevation.
2. An end elevation looking. A →
3. A section through. P-P.
4. A plan.

CONNECTING ROD END solid type

SHEET No 10.A



Draw full size.

1. A front elevation with upper half in section.

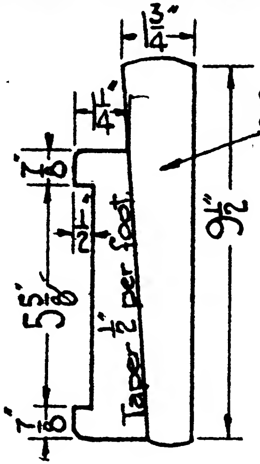
2. A sectional end elevation through A-A.

3. A complete plan.

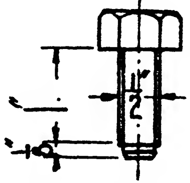
CONNECTING ROD END STRAP TYPE.

SHEET No. 11. A.

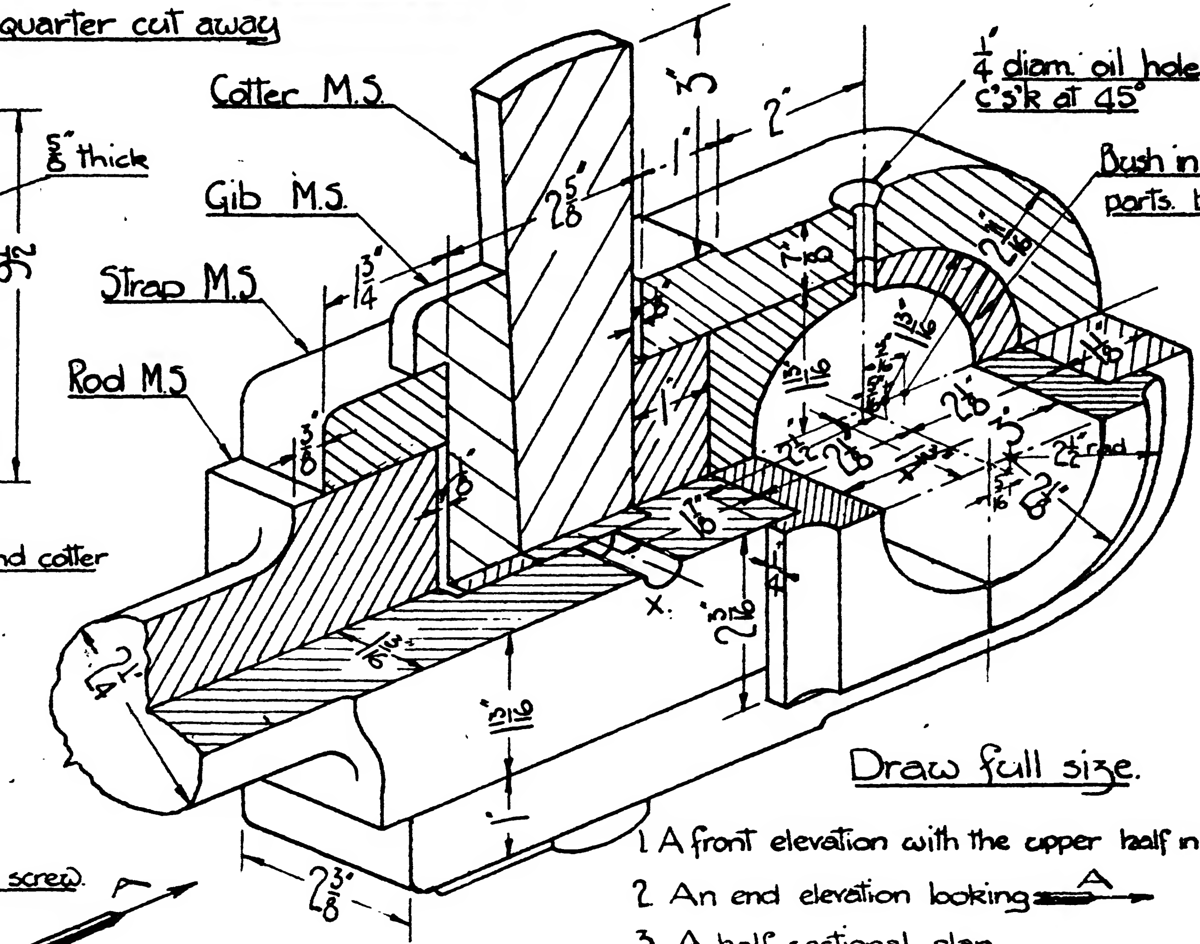
Shown with a quarter cut away



Detail of gib and cotter



Detail of locking screw. at X.

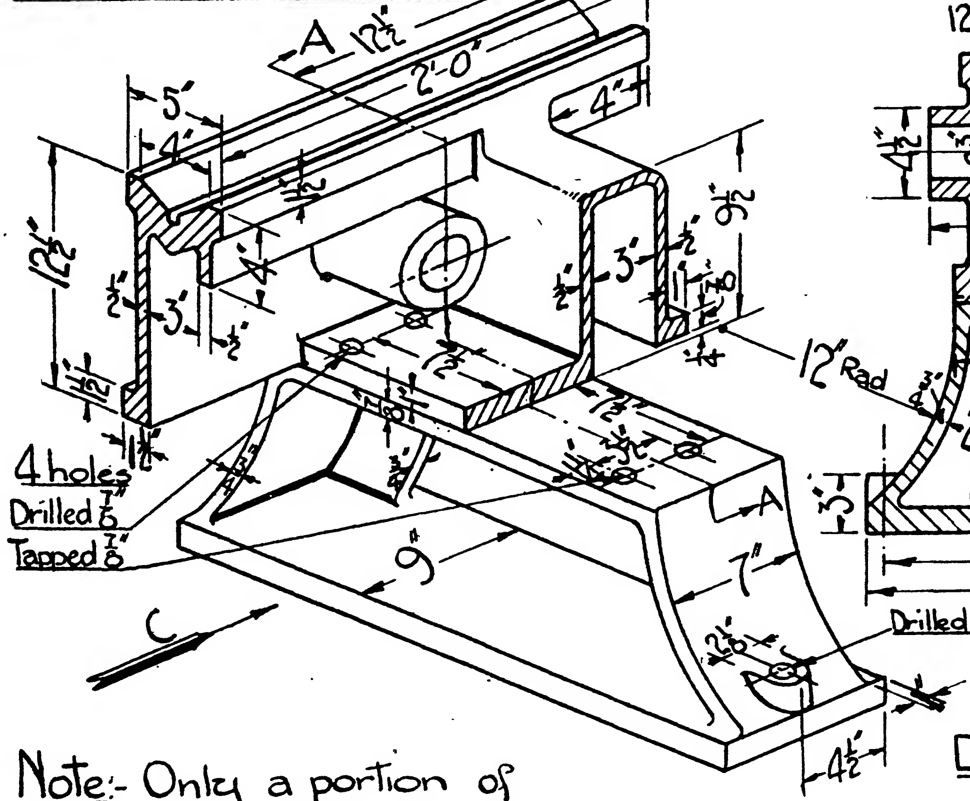


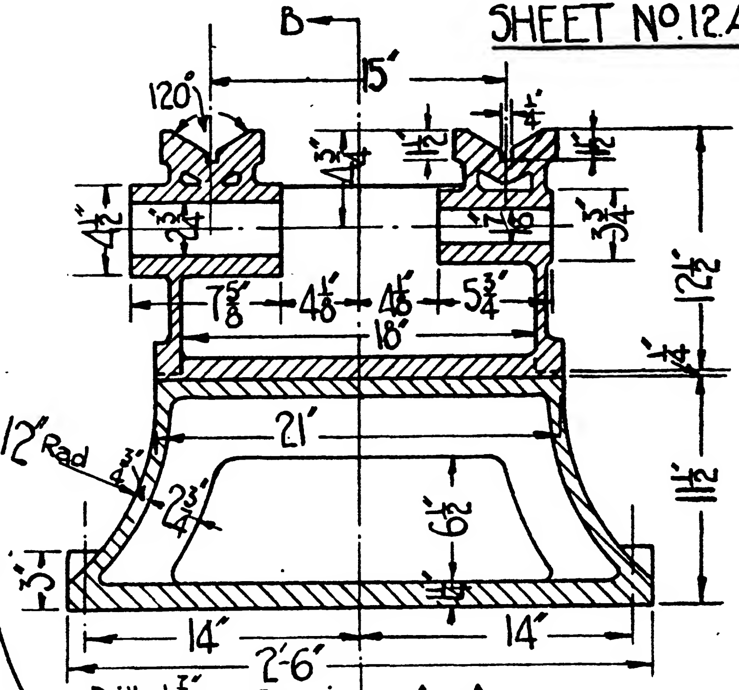
Draw full size.

1. A front elevation with the upper half in section
2. An end elevation looking A
3. A half sectional plan.

PLANE BED cast iron.

SHEET No. 12A





Section A-A

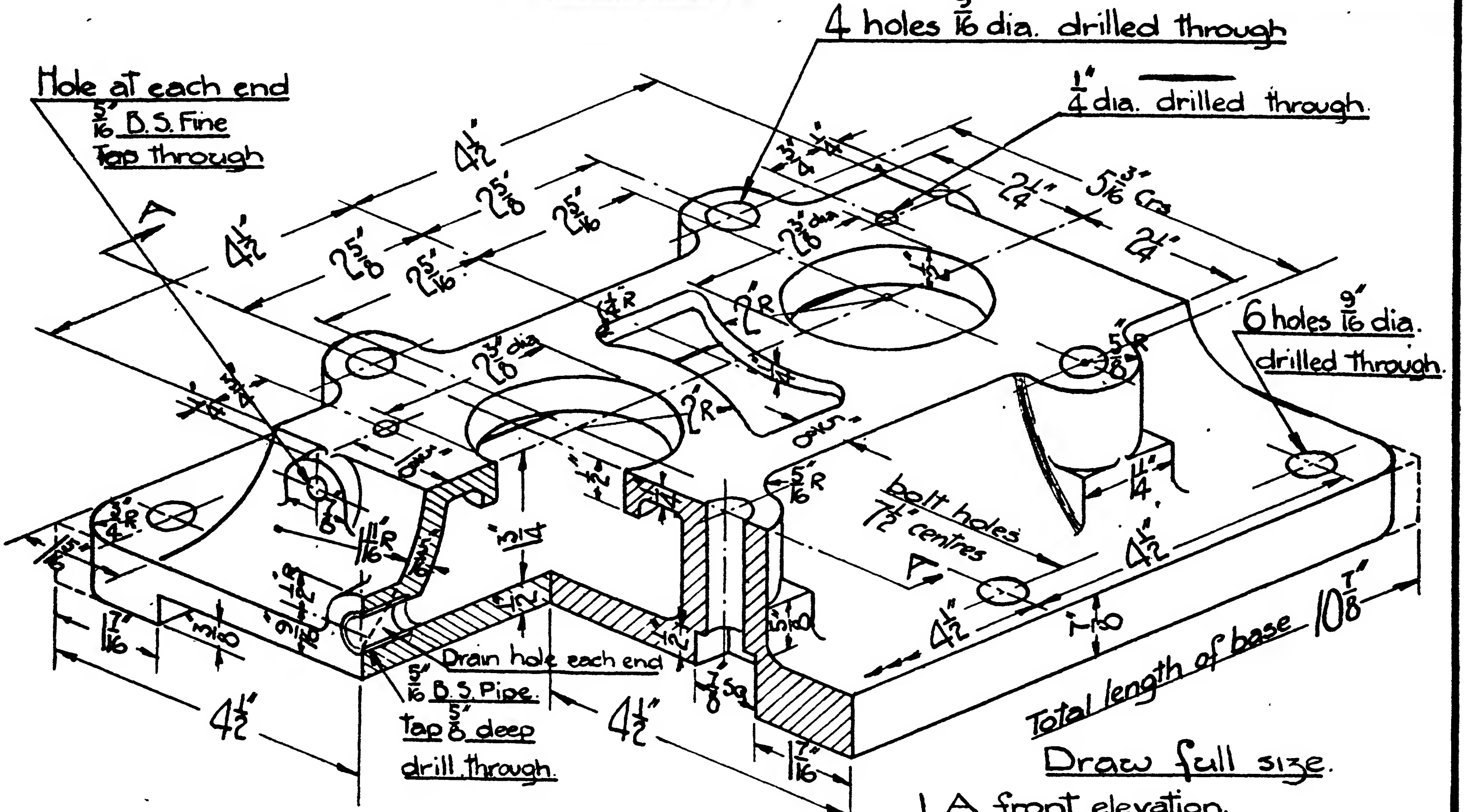
Note:- Only a portion of the length of the bed is shown.

Draw to scale 3" = 1 foot.

1. A sectional elevation through B-B
2. An end elevation looking C →
3. A plan projected from 2.

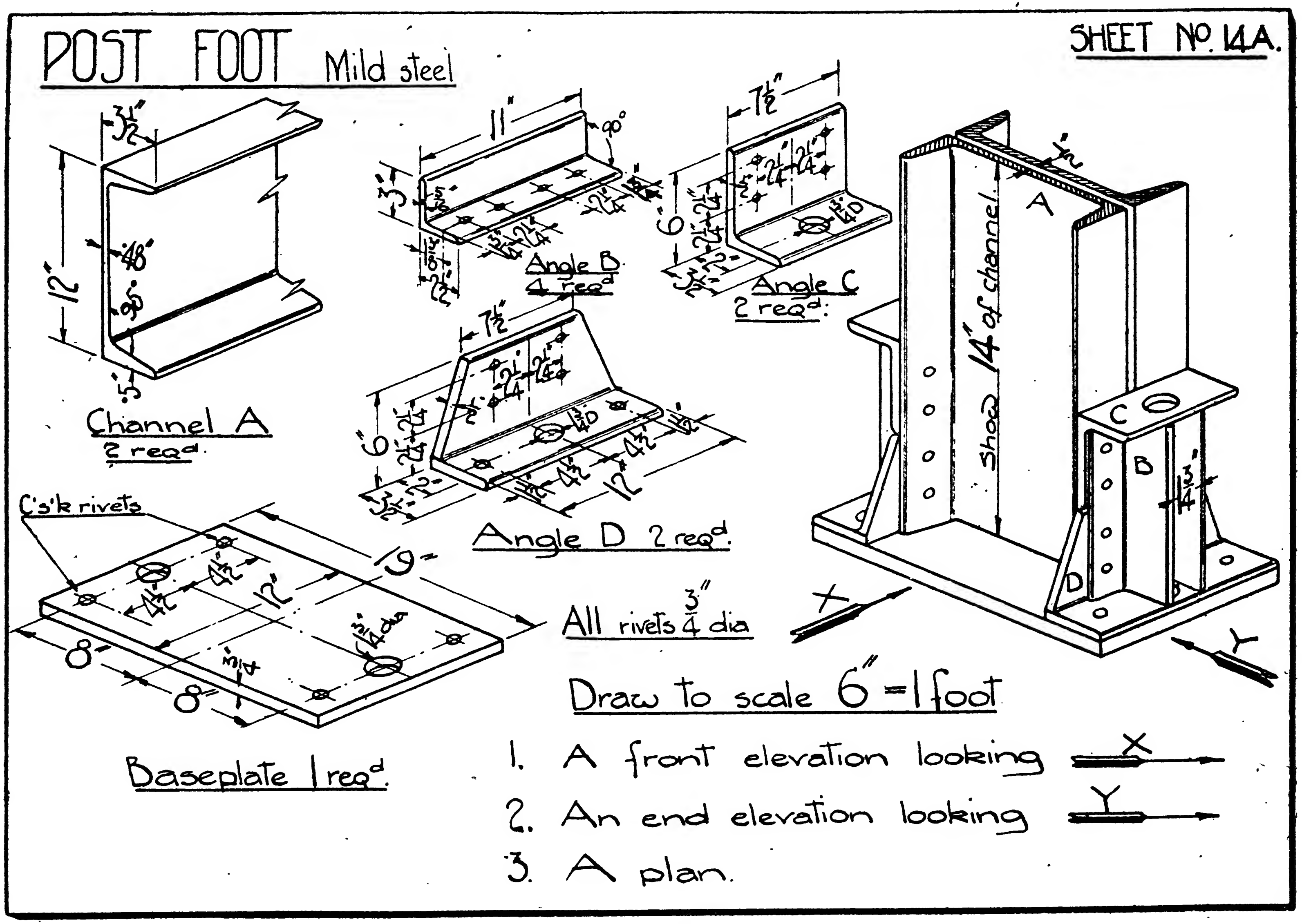
PUMP BASEPLATE cast iron

SHEET No 13A



Draw full size.

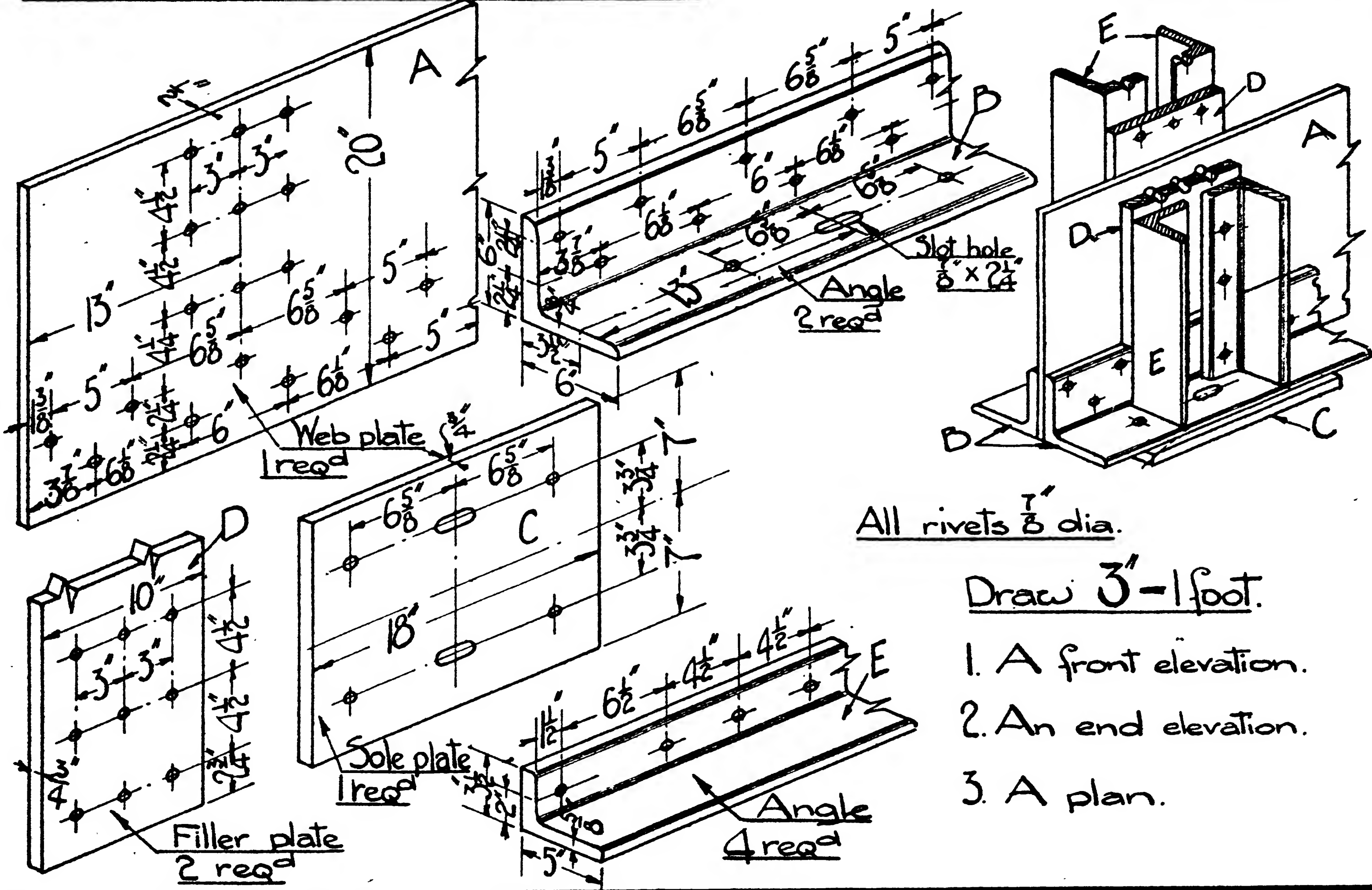
1. A front elevation.
2. A sectional end elevation through A-A
3. A complete plan.



POST FOOT Mild steel
SHEET No. 14A.
Channel A
2 reqd.
Angle B
4 reqd.
Angle C
2 reqd.
Angle D 2 reqd.
Baseplate 1 reqd.
C's'k rivets
All rivets 3/4" dia
Show 14" of channel
Draw to scale 6" = 1 foot
1. A front elevation looking X
2. An end elevation looking Y
3. A plan.

BUILT-UP GIRDER END. Mild steel.

SHEET No. 15A



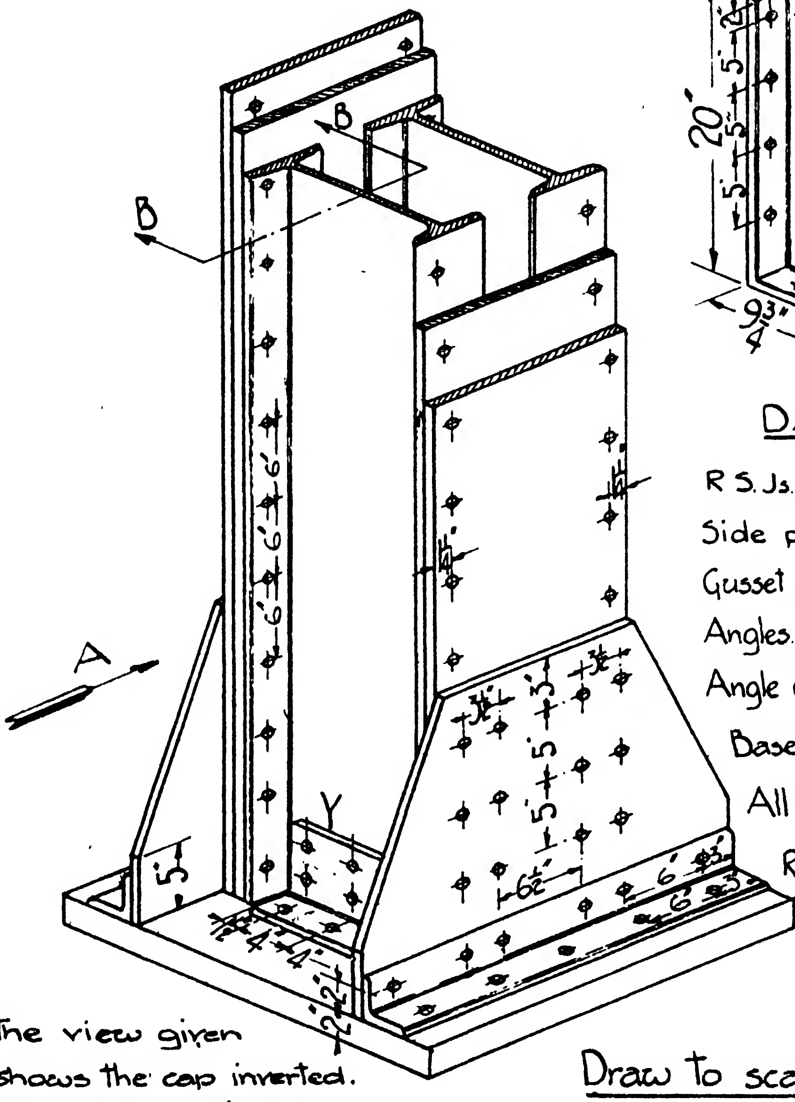
All rivets 7/8" dia.

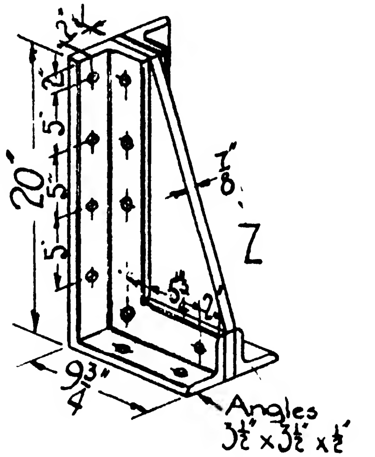
Draw 3"–1 foot.

1. A front elevation.
2. An end elevation.
3. A plan.

CAP & BASE for STANCHION. Mild steel.

SHEET No. 16A





DATA.

R.S.Js. 14" x 6" x 57 lbs
Side plates 16" x ¾" thick
Gusset plates 30" x 20" x ⅞" thick
Angles. 3½" x 3½" x ½" x 30" long
Angle cleats 6" x 3½" x ½" x 11"
Baseplate 30" sq x 2" thick.
All rivets ¾" dia.
Rivets in baseplate to be csk on the underside.

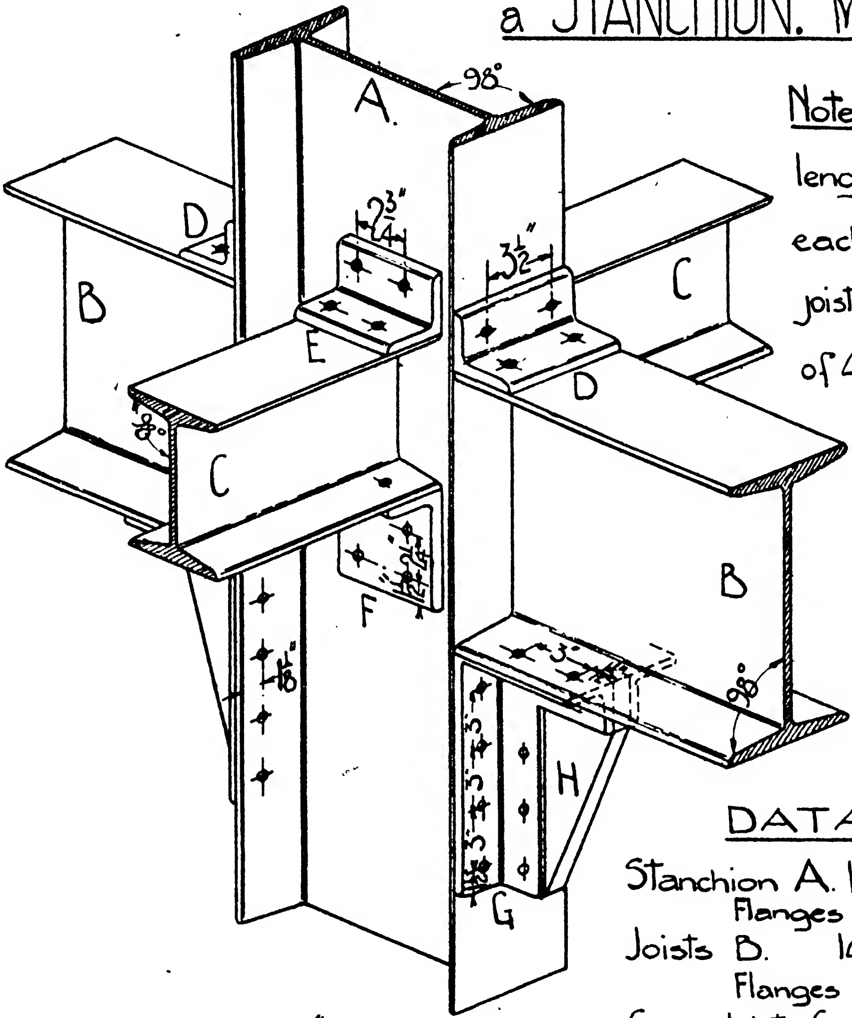
The view given shows the cap inverted. The base is similar except that the gussets Z are substituted for the angles Y, and provision should be made for 4 bolt holes 1½" dia 22¾" x 18" centres

Draw to scale 1½" = 1 foot.

1. An elevation of cap, and base in correct relative position looking → A
2. An end elevation of the base only, half in section on B-B.
3. A plan projected from the end elevation.

CONNECTIONS of FLOOR JOISTS to a STANCHION. Mild steel.

SHEET No. 17.A.



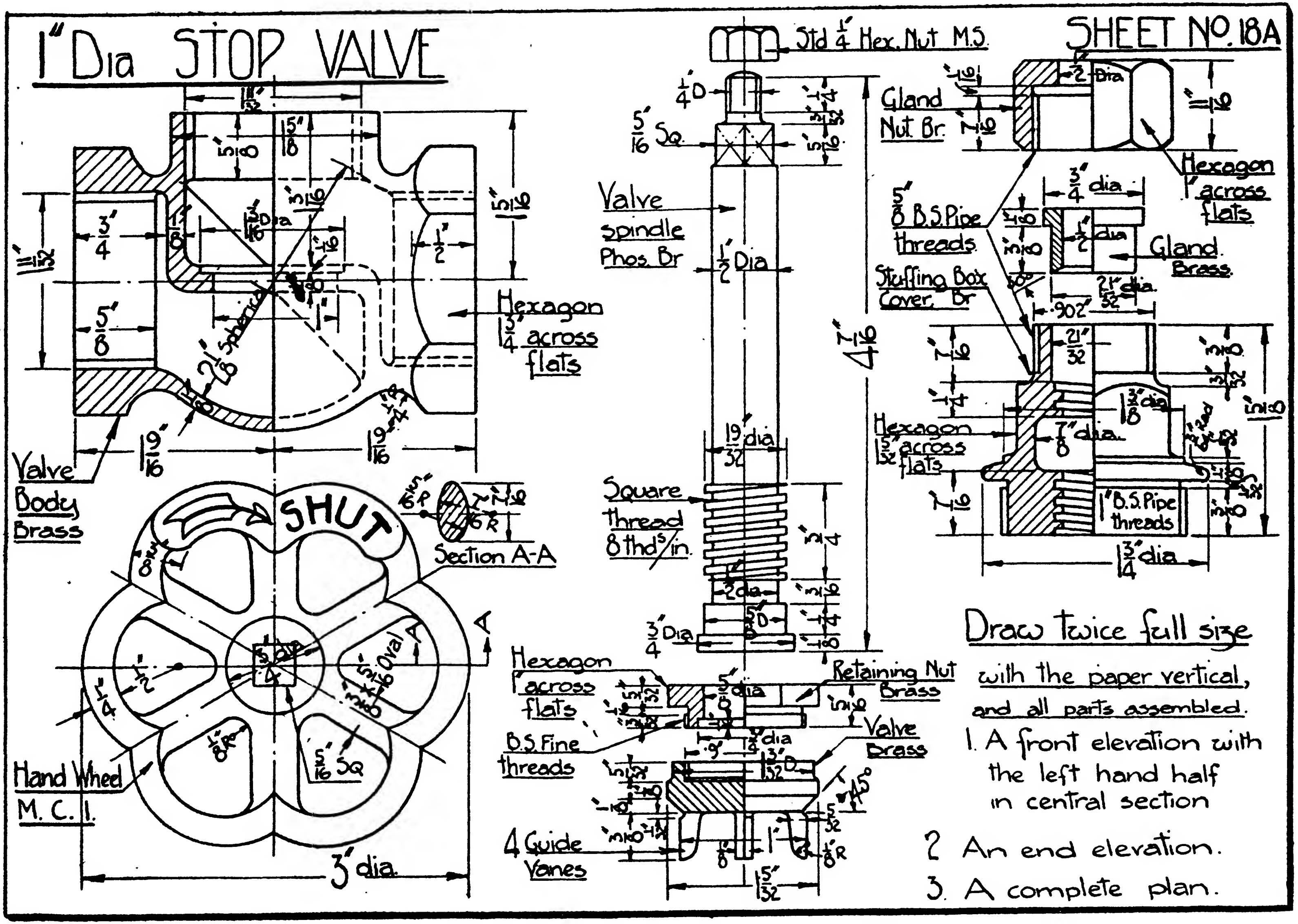
Note:- Show a length of 12" for each horizontal joist, and a length of 4 ft. for stanchion.

DATA.

Stanchion A. 12" x 6" x 54 lbs.
Flanges ·883" Web ·5".
Joists B. 14" x 6" x 57 lbs.
Flanges ·873" Web ·5".
Cross Joists C. 8" x 5" x 28 lbs.
Flanges ·575" Web ·35".
Angles D. 3" x 3" x $\frac{1}{2}$" x 6" long.
Angles E. 3" x 3" x $\frac{1}{2}$" x 5" long.
Angles F. 6" x 3" x $\frac{1}{2}$" x 5" long.
Angles G. $2\frac{1}{2}$" x $2\frac{1}{2}$" x $\frac{3}{8}$" bent at right angle 12" x 6"
Gusset plates H. 12" x 6" x 1" thick.
All bolts and rivets $\frac{3}{4}$" dia.
Bolts shown ●.
Rivets shown ○.

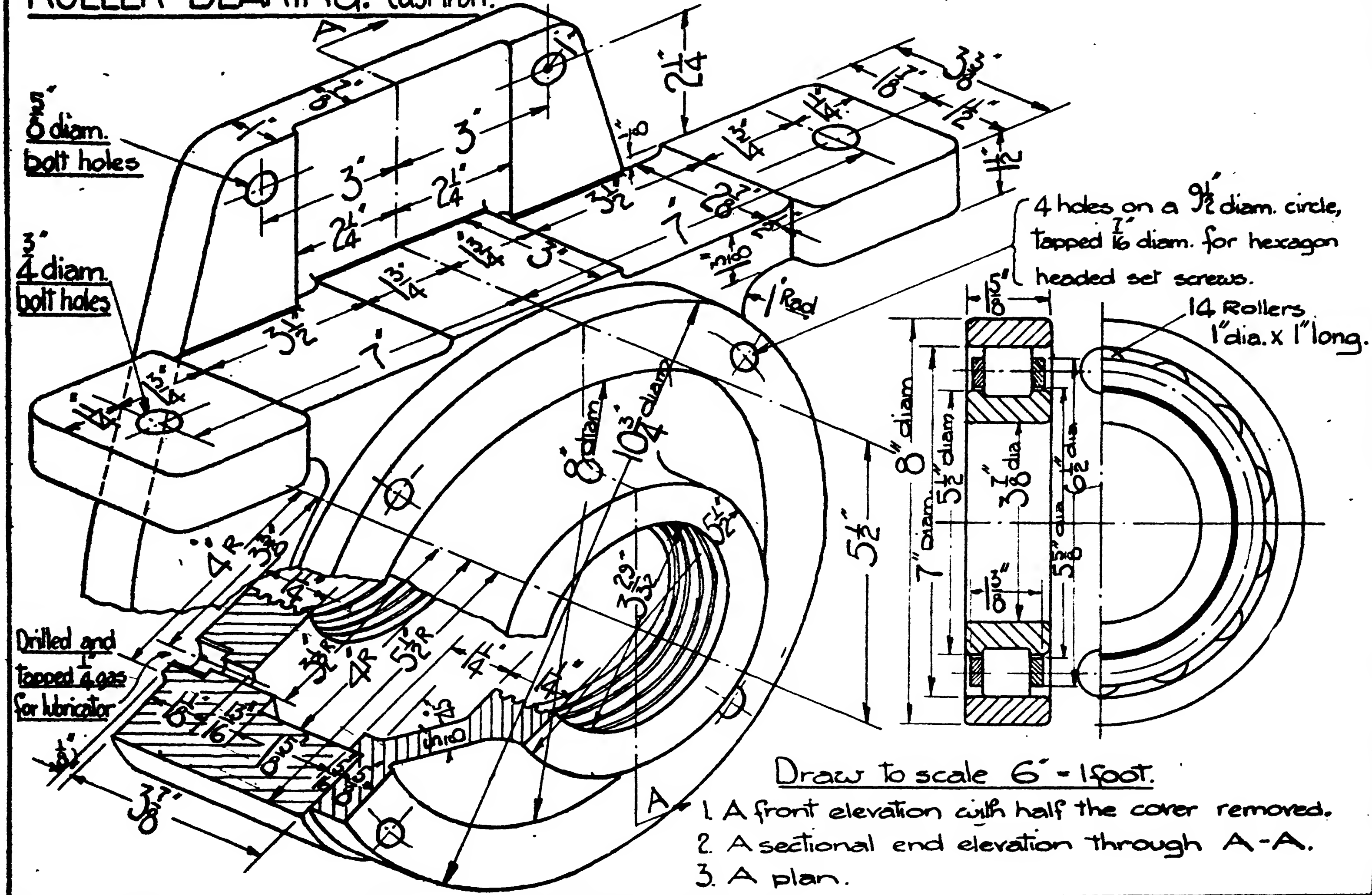
Draw to scale $1\frac{1}{2}$" = 1 foot.

1. A front elevation.
2. An end elevation.
3. A plan.


1" Dia STOP VALVE
SHEET No. 18A
Std 1/4" Hex. Nut M.S.
Gland Nut Br.
Hexagon 1" across flats
5/8" B.S. Pipe threads
Gland Brass
Stuffing Box Cover Br
Hexagon 1 5/32" across flats
1" B.S. Pipe threads
1 3/4" dia
Valve spindle Phos. Br
1/2" Dia
5/16 Sq.
Square thread 8 thds/in.
Retaining Nut Brass
Valve Brass
Hexagon 1" across flats
B.S. Fine threads
4 Guide Vanes
Hexagon 1 3/4" across flats
Valve Body Brass
2 1/8" Spherical
Section A-A
SHUT
Hand Wheel M.C.I.
3" dia.
5/16 Sq
Draw twice full size
with the paper vertical,
and all parts assembled.
1. A front elevation with the left hand half in central section
2. An end elevation.
3. A complete plan.

ROLLER BEARING. Cast iron.

SHEET No. 19 A.

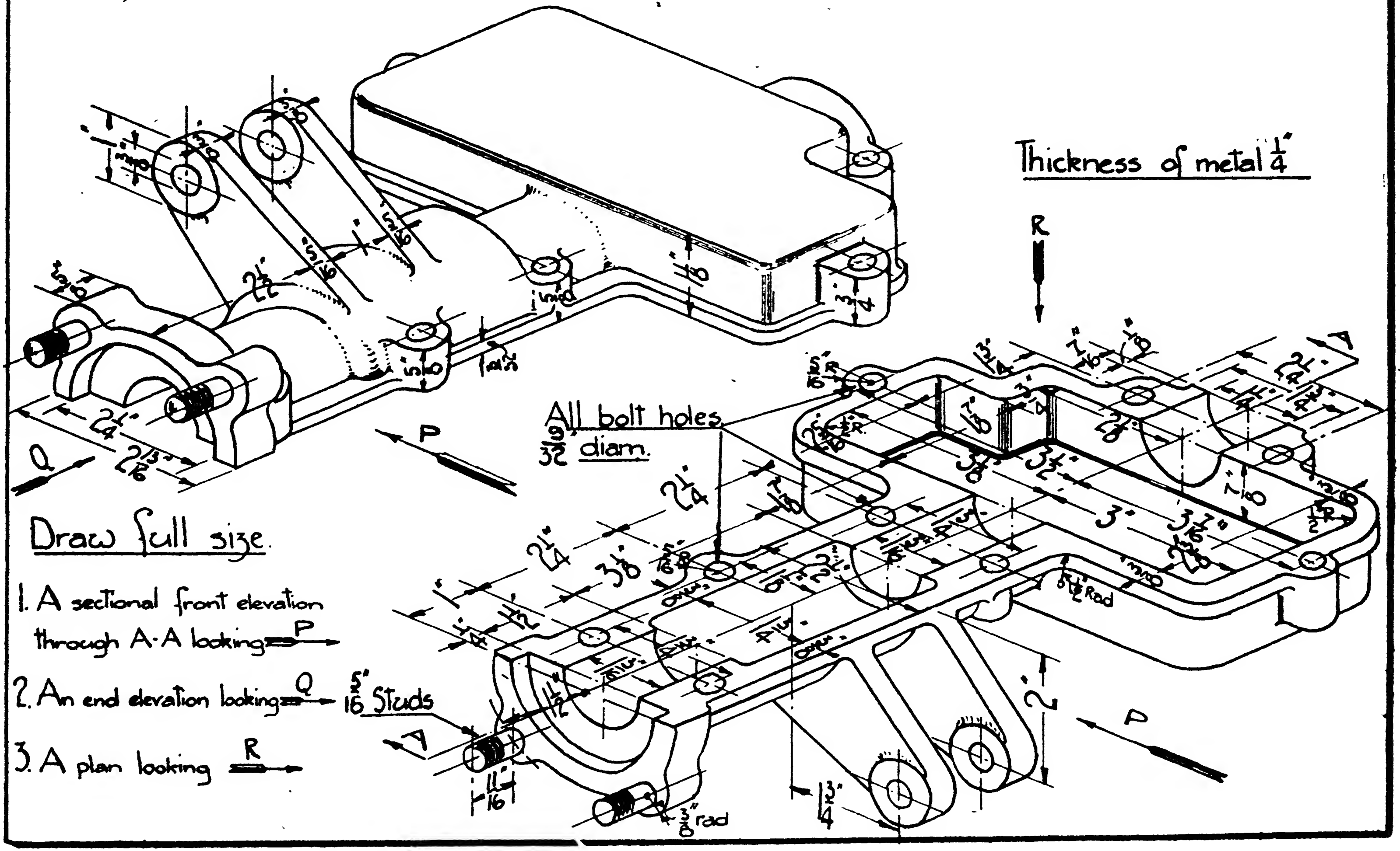


Draw to scale 6" - 1 foot.

1. A front elevation with half the cover removed.
2. A sectional end elevation through A-A.
3. A plan.

AERO GEAR COVER Alum. alloy

SHEET No. 20A.

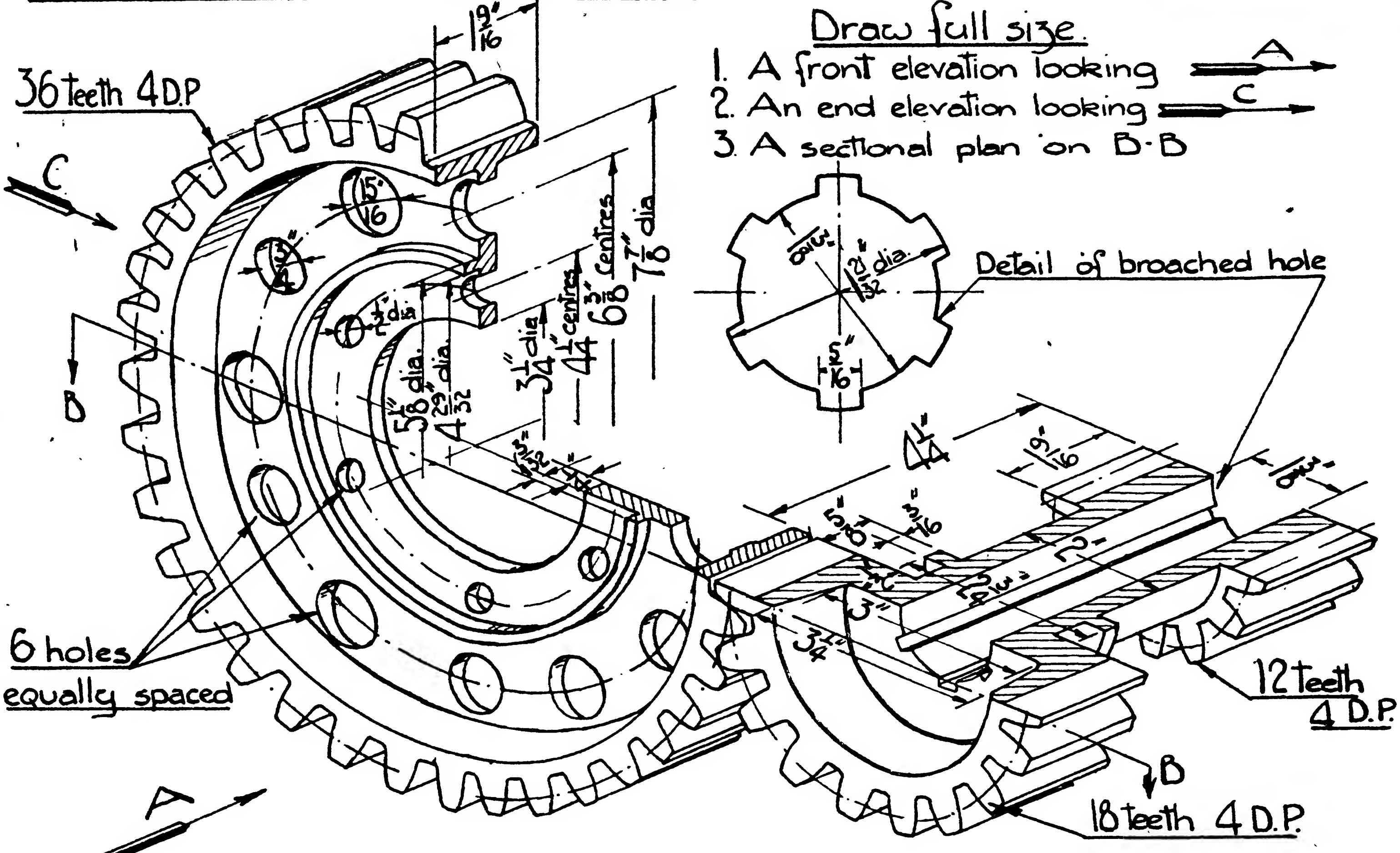


Draw full size.

1. A sectional front elevation through A-A looking P
2. An end elevation looking Q
3. A plan looking R

SPUR GEAR WHEELS Mild Steel

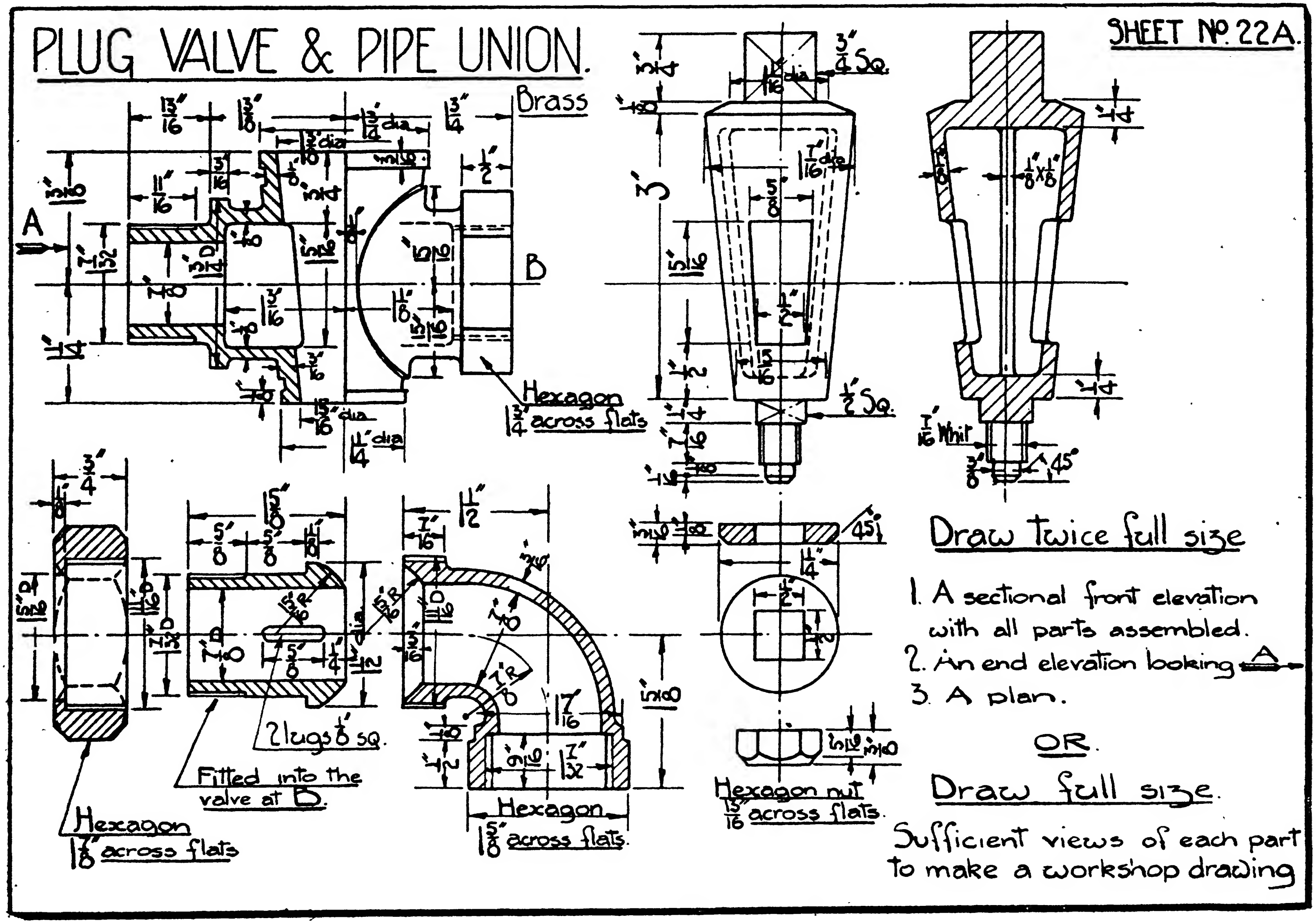
SHEET No. 21.A.



Draw full size.

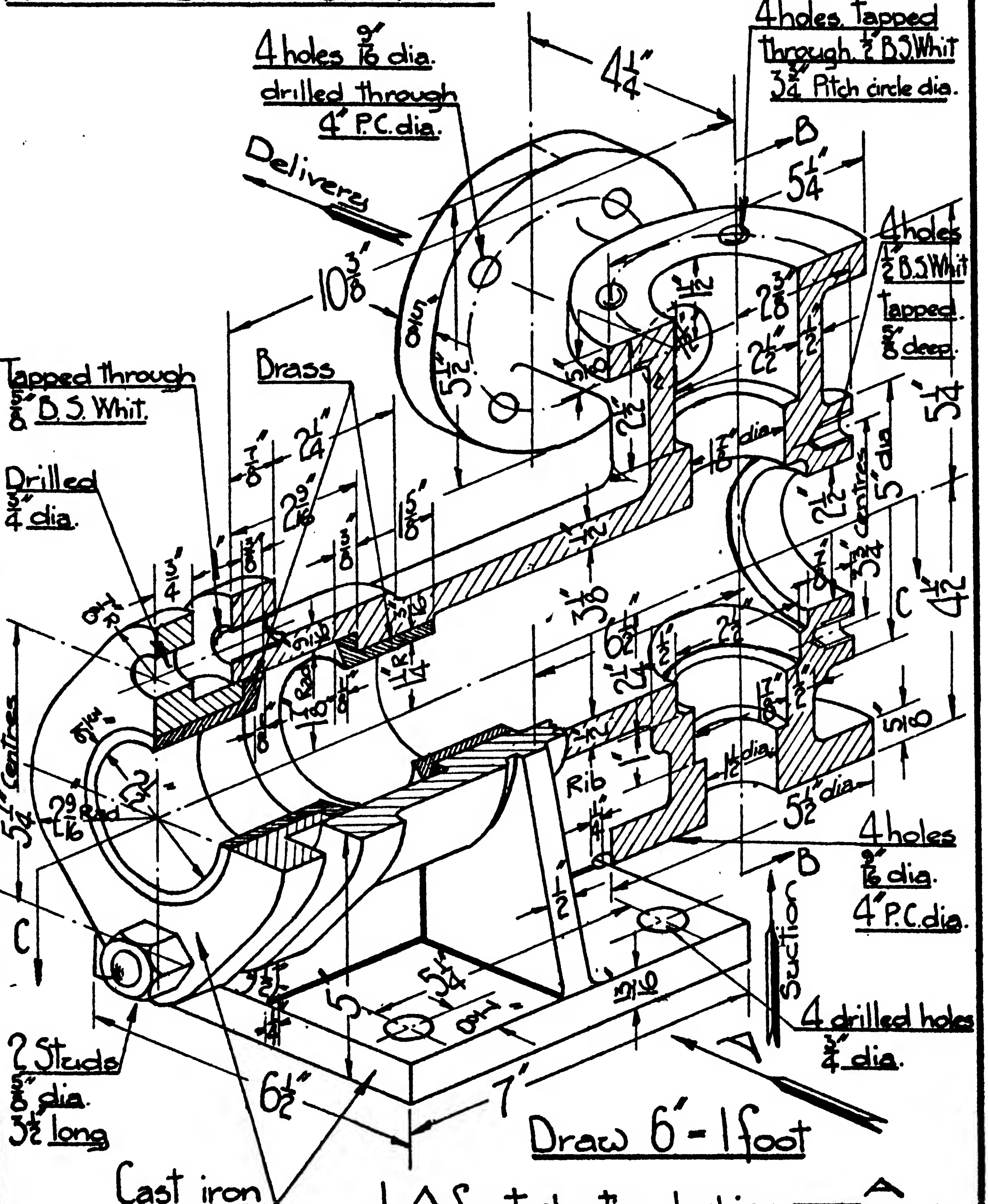
1. A front elevation looking A
2. An end elevation looking C
3. A sectional plan on B-B

Refer to page 24 for information on Gears.


PLUG VALVE & PIPE UNION.
SHEET No. 22A.
Brass
A
B
Hexagon 1 3/4" across flats
2 lugs 1/8" sq.
Fitted into the valve at B.
Hexagon 1 7/8" across flats
Hexagon 1 5/8" across flats
Hexagon nut 15/16" across flats
3/4" Sq.
1/2" Sq.
1/16" Whit
Draw Twice full size
1. A sectional front elevation with all parts assembled.
2. An end elevation looking A
3. A plan.
OR
Draw full size
Sufficient views of each part to make a workshop drawing

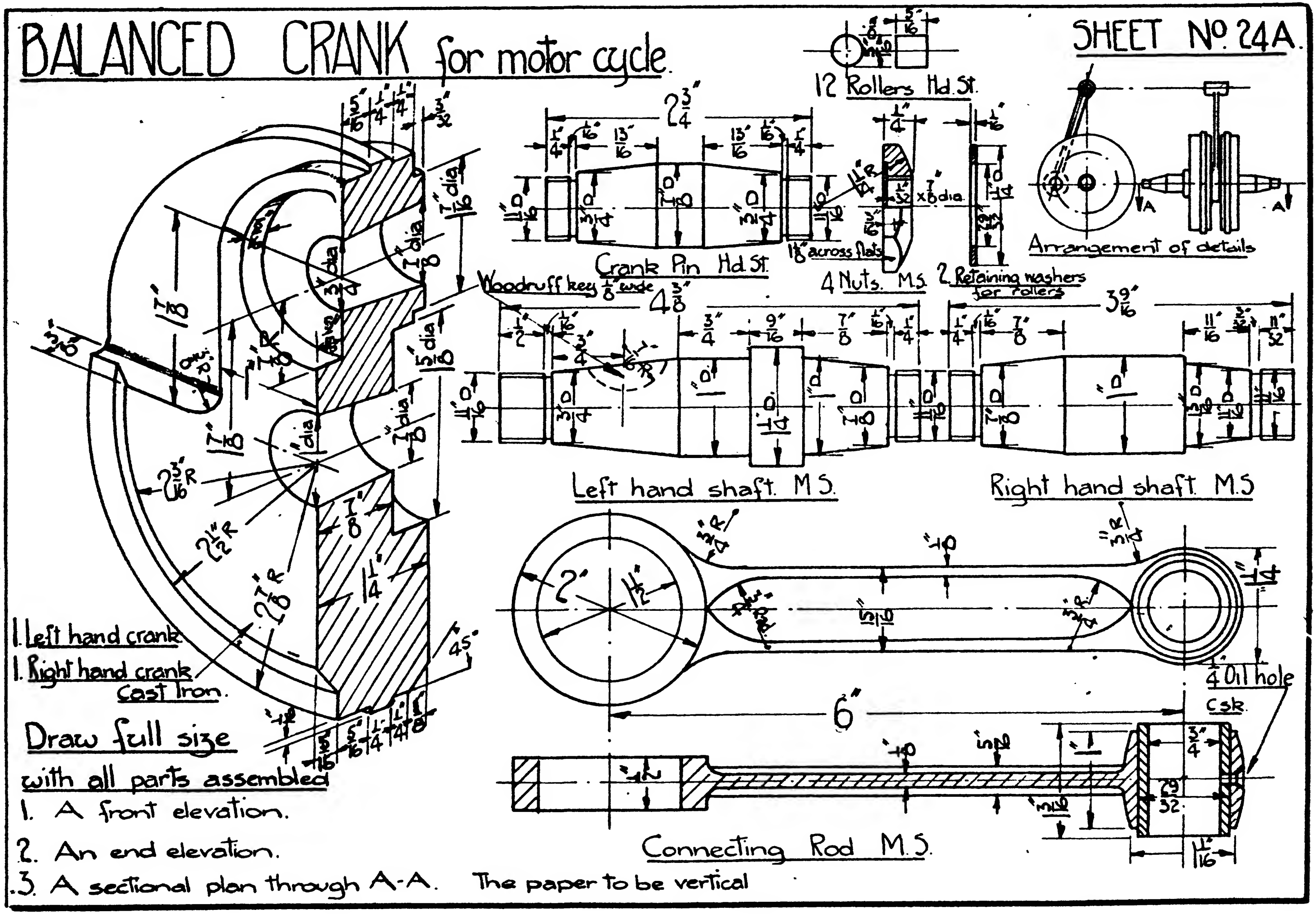
RAM PUMP BARREL

SHEET No. 23.A



Draw 6"-1foot

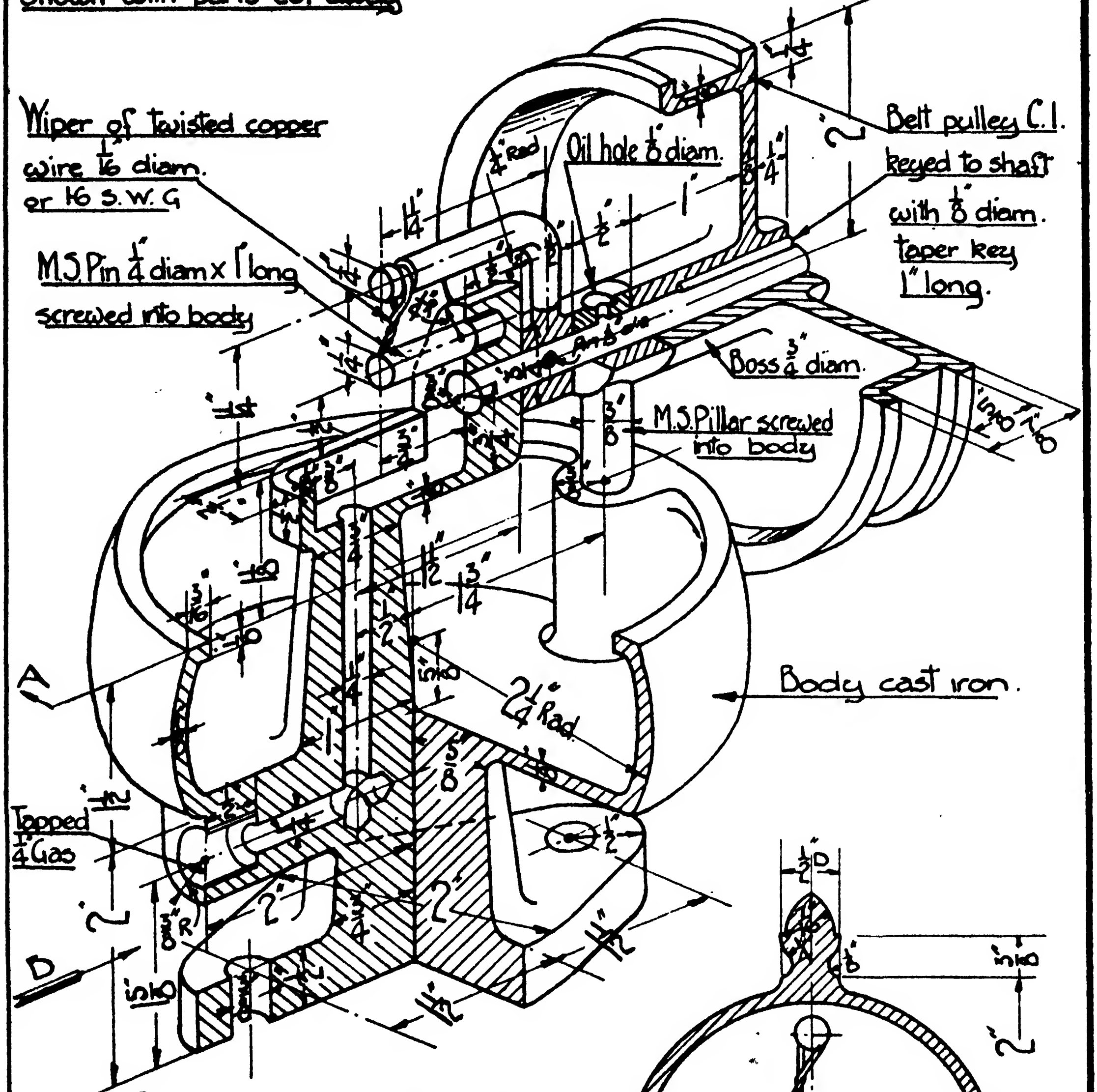
1. A front elevation looking → A
2. A sectional end elevation through B-B.
3. A sectional plan through C-C.

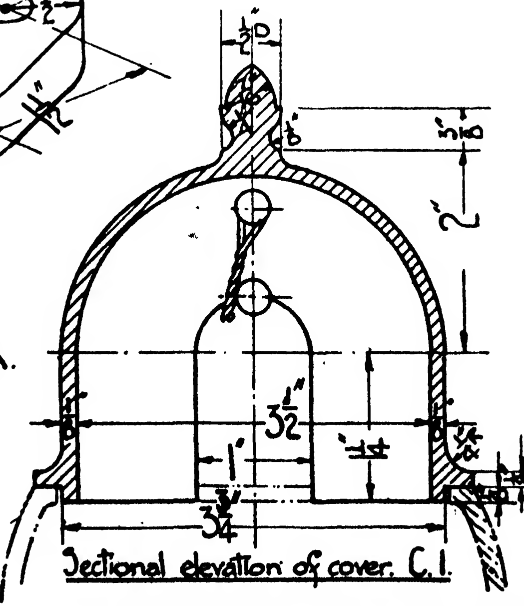

BALANCED CRANK for motor cycle
SHEET No 24A.
12 Rollers Hd. St.
Crank Pin Hd. St.
4 Nuts. M.S.
2 Retaining washers for rollers
Arrangement of details
Woodruff keys 1/8 wide
Left hand shaft M.S.
Right hand shaft M.S
1/4 Oil hole Csk.
Connecting Rod M.S.
1. Left hand crank
1. Right hand crank
Cast Iron.
Draw full size
with all parts assembled
1. A front elevation.
2. An end elevation.
3. A sectional plan through A-A.
The paper to be vertical

AUTOMATIC LUBRICATOR for Gas Engine.

SHEET No. 25A

Shown with parts cut away



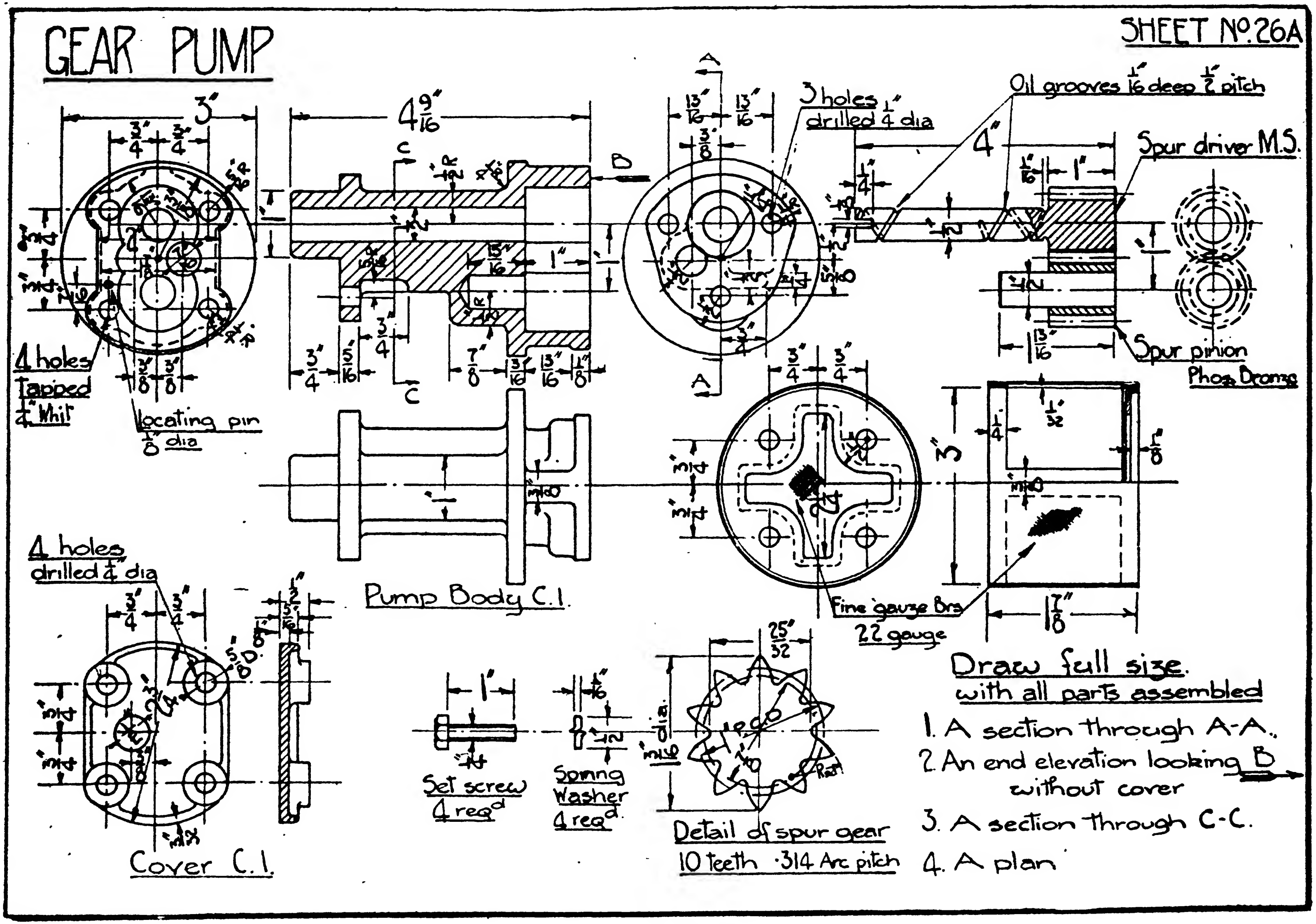


Draw full size with cover in position

1. A sectional front elevation through A-A.

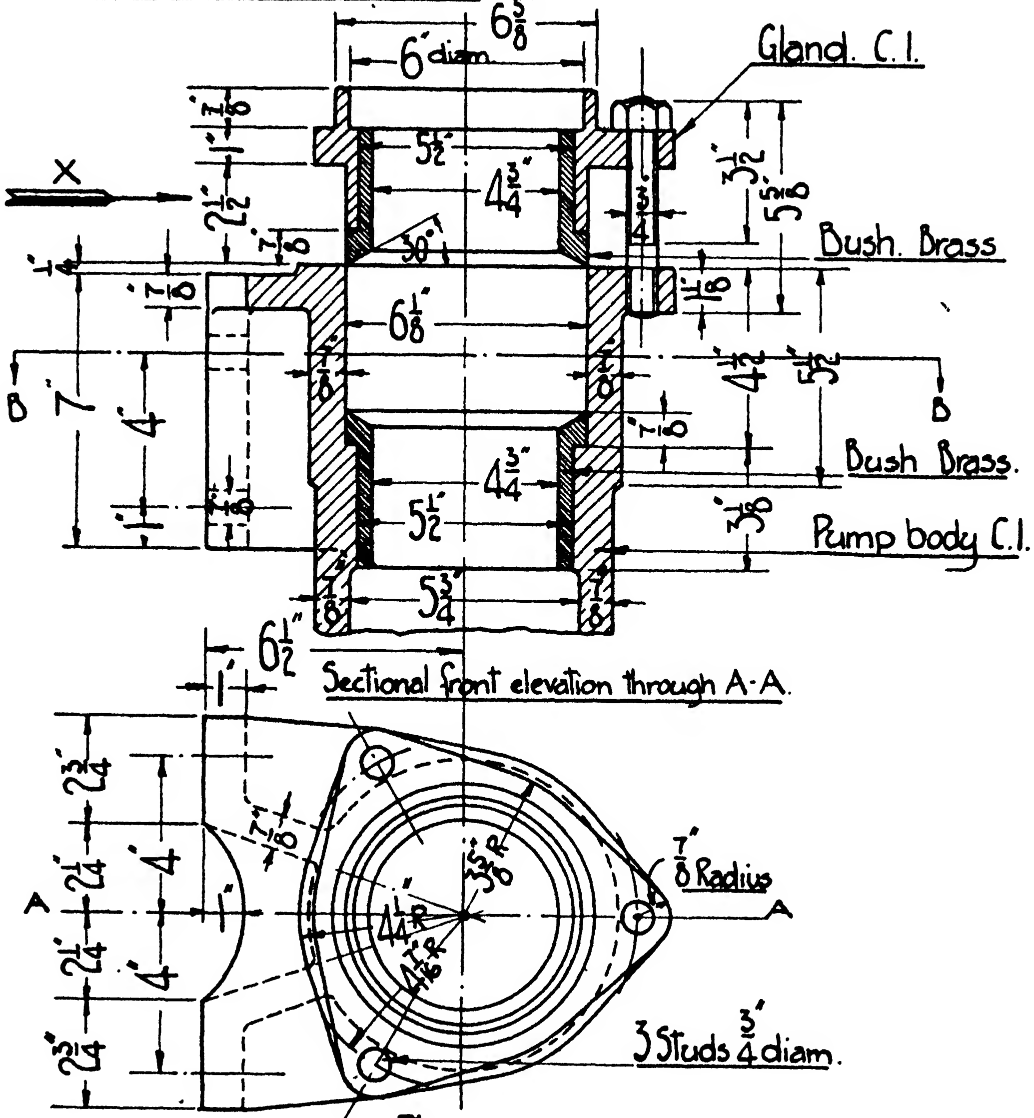
2. An end elevation looking D without cover.

3. A complete plan.


GEAR PUMP
SHEET No. 26A
Oil grooves 1/16" deep 1/2" pitch
3 holes 1/4" drilled 4 dia
Spur driver M.S.
Spur pinion Phos. Bronze
4 holes Tapped 1/4" Whit
Locating pin 1/8" dia
4 holes drilled 1/4" dia
Pump Body C.I.
Cover C.I.
Fine gauze Brs 22 gauge
Set screw 4 reqd
Spring Washer 4 reqd
Detail of spur gear
10 teeth ·314 Arc pitch
Draw full size with all parts assembled
1. A section through A-A.
2. An end elevation looking B without cover
3. A section through C-C.
4. A plan

PUMP STUFFING BOX

SHEET No. 1.B.



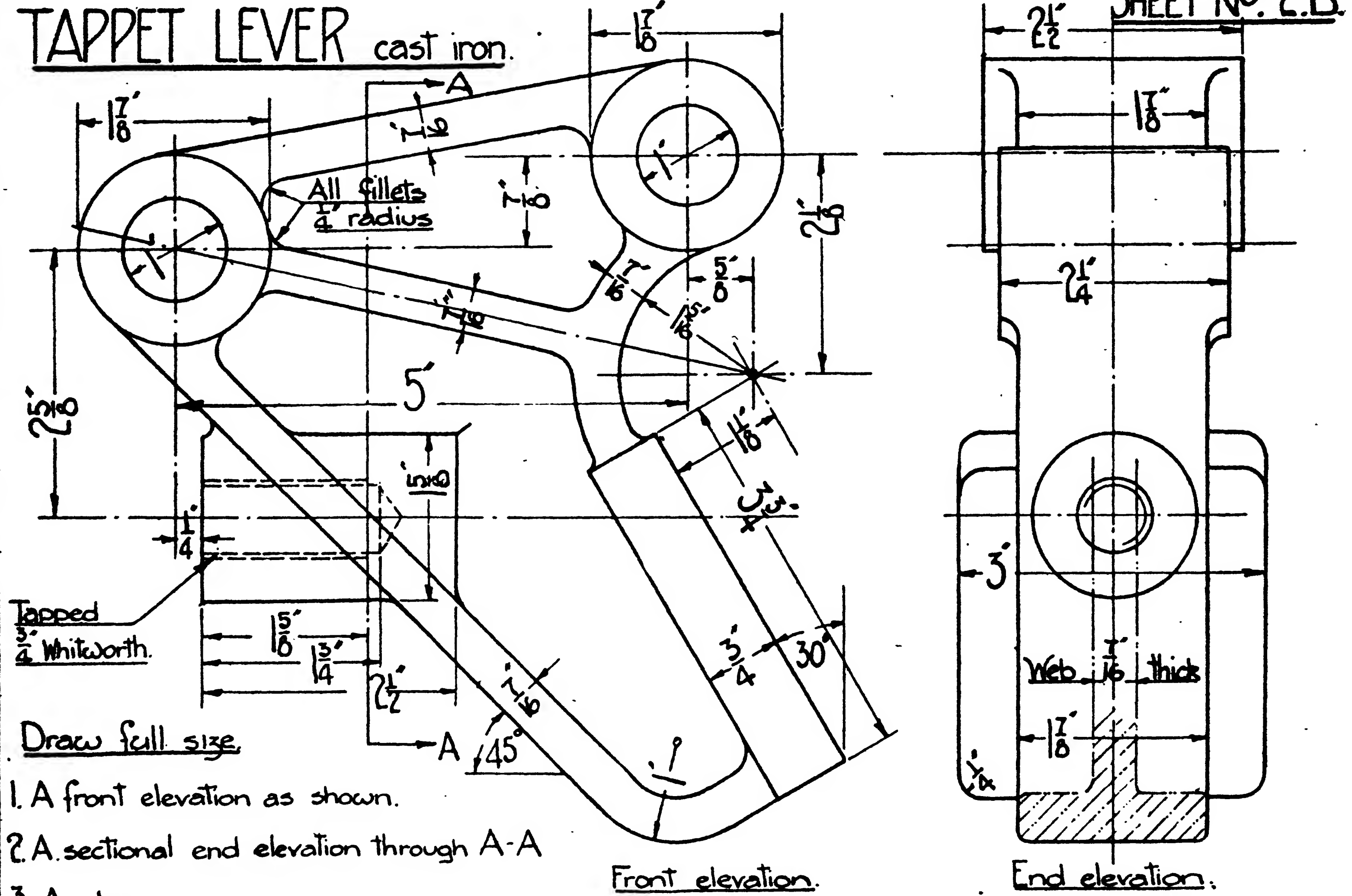
Plan.

Draw to scale of 6" = 1 foot.

1. A sectional front elevation through A-A.
2. A sectional plan through B-B.
3. An end elevation looking in direction X →

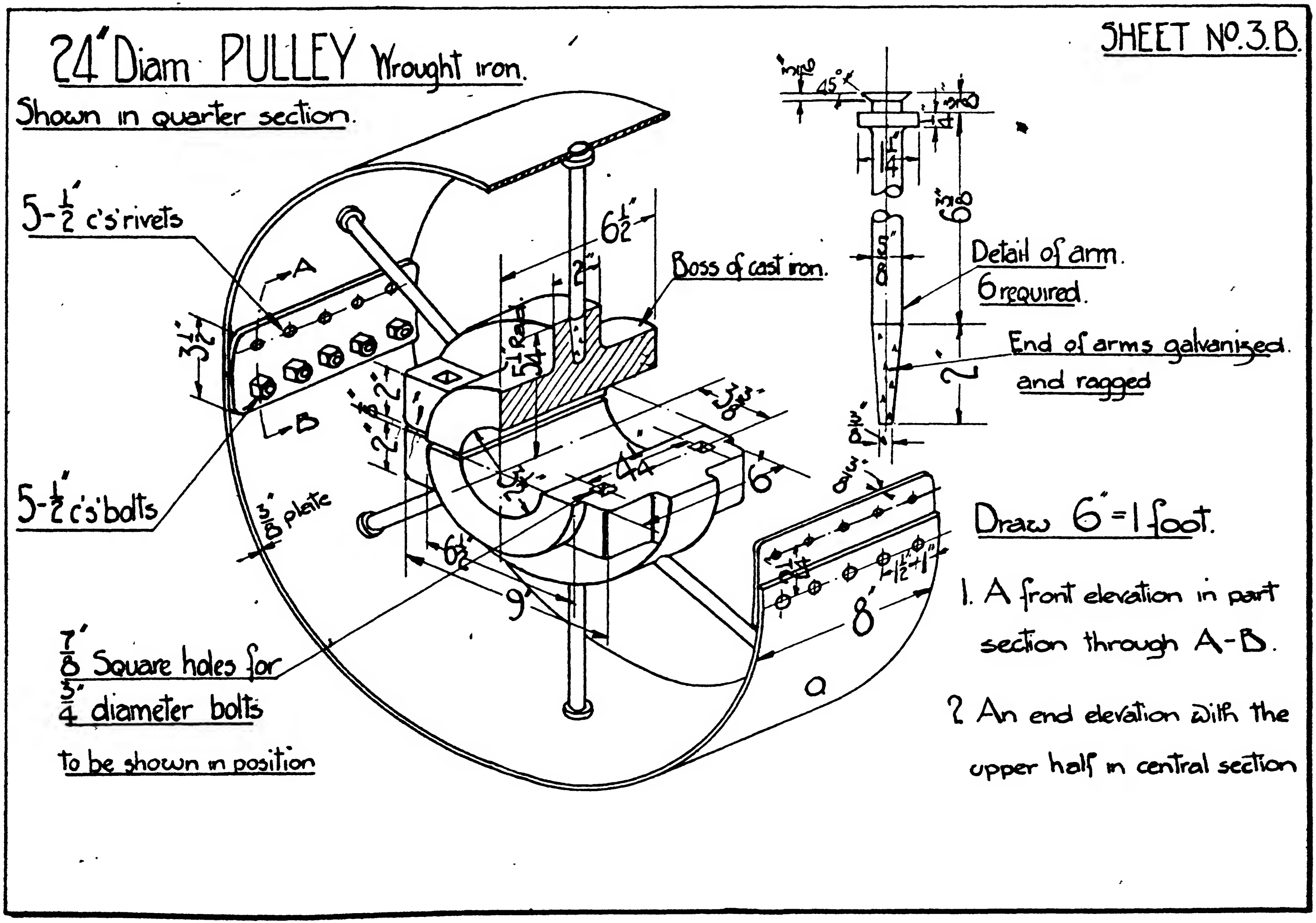
TAPPET LEVER cast iron.

SHEET No. 2.B.



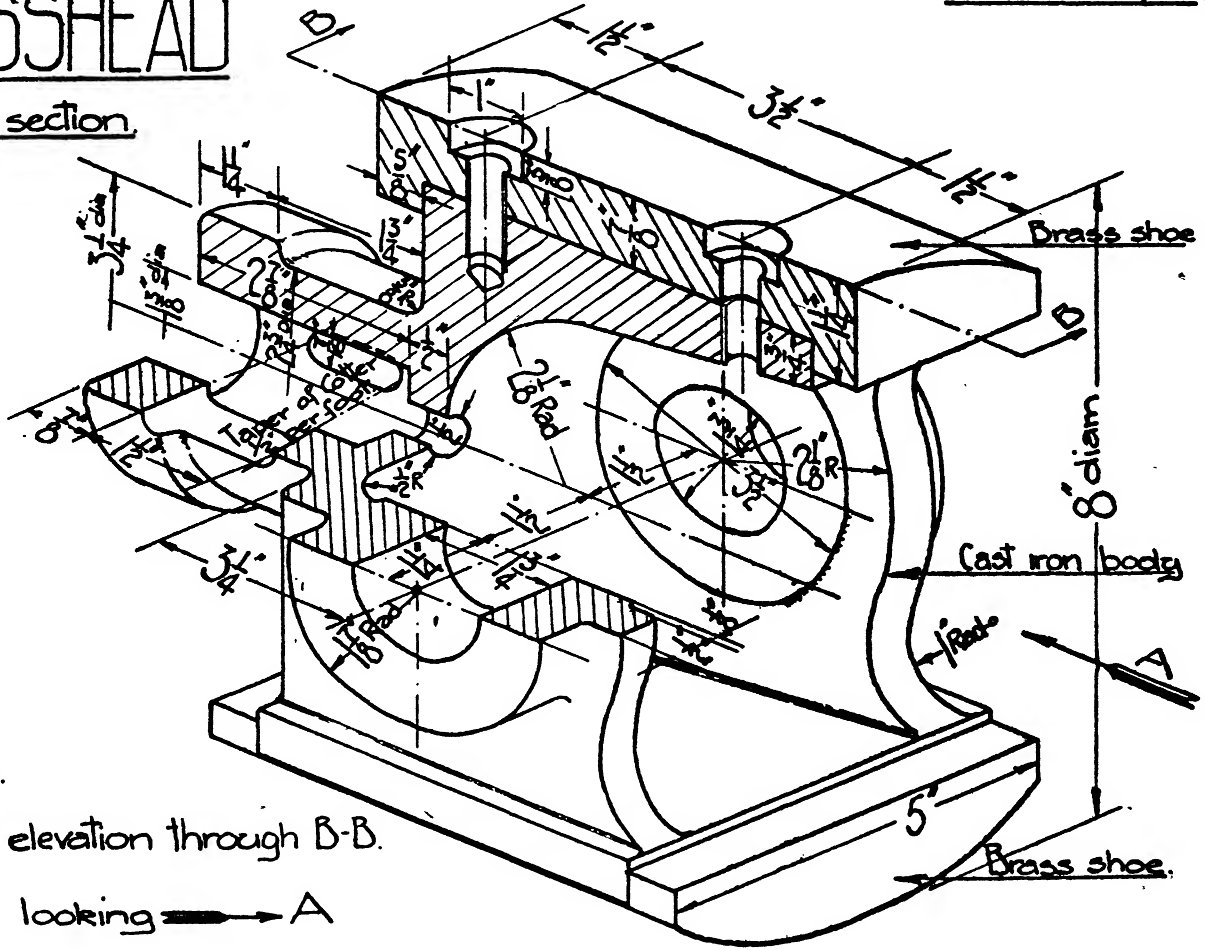
Draw full size.

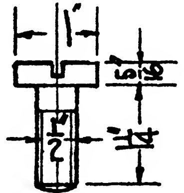
1. A front elevation as shown.
2. A sectional end elevation through A-A
3. A plan.


24" Diam PULLEY Wrought iron.
Shown in quarter section.
SHEET No. 3.B.
5-1/2" c's rivets
5-1/2" c's bolts
7/8" Square holes for
3/4" diameter bolts
to be shown in position
3/8" plate
A
B
Boss of cast iron.
Detail of arm.
6 required.
End of arms galvanised
and ragged
45°
Draw 6" = 1 foot.
1. A front elevation in part
section through A-B.
2 An end elevation with the
upper half in central section

PUMP CROSSHEAD

Shown in quarter section.





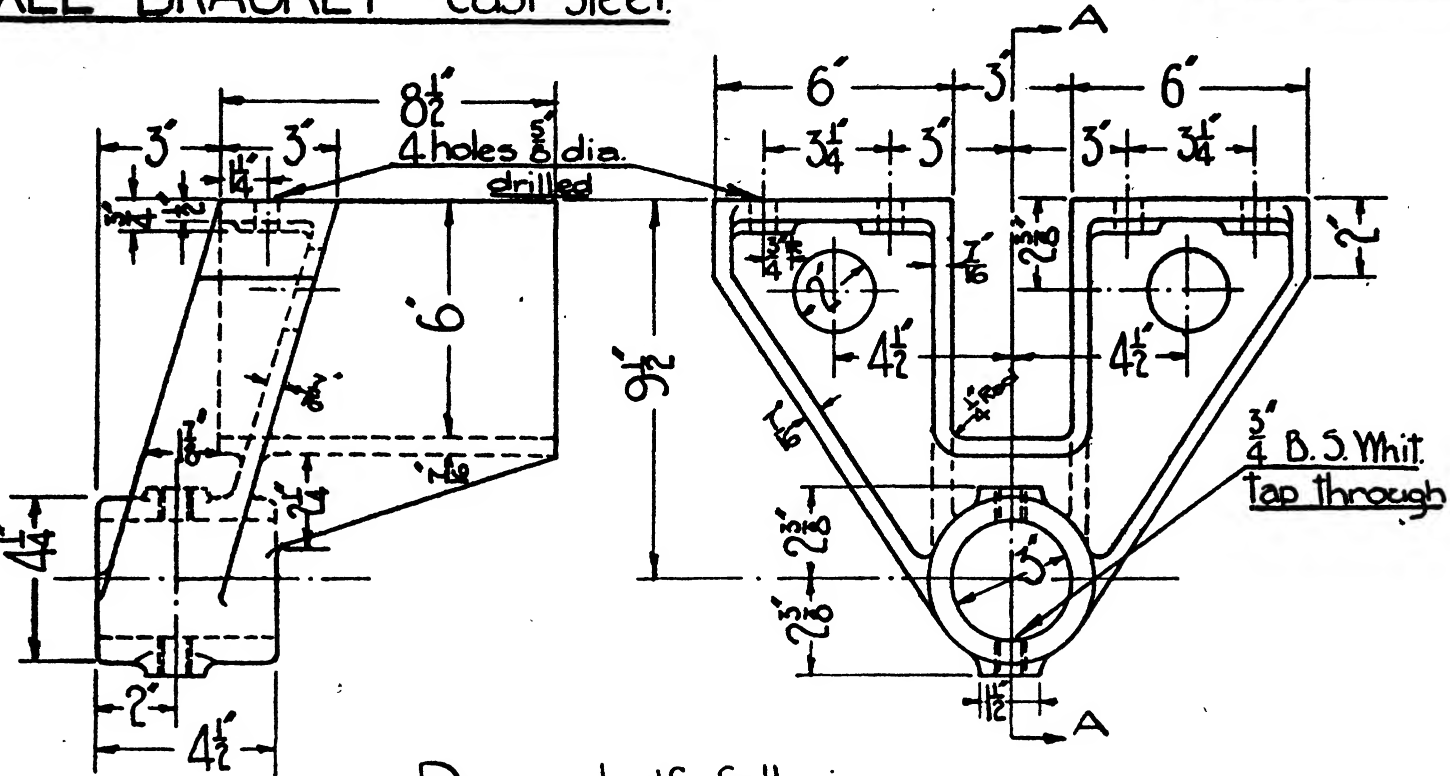
Detail of set screw.
4 required M.S.
To be shown fixed in position

Draw full size.

1. A sectional front elevation through B-B.
2. An end elevation looking → A
3. A complete plan

AXLE BRACKET cast steel.

SHEET No. 5.B.

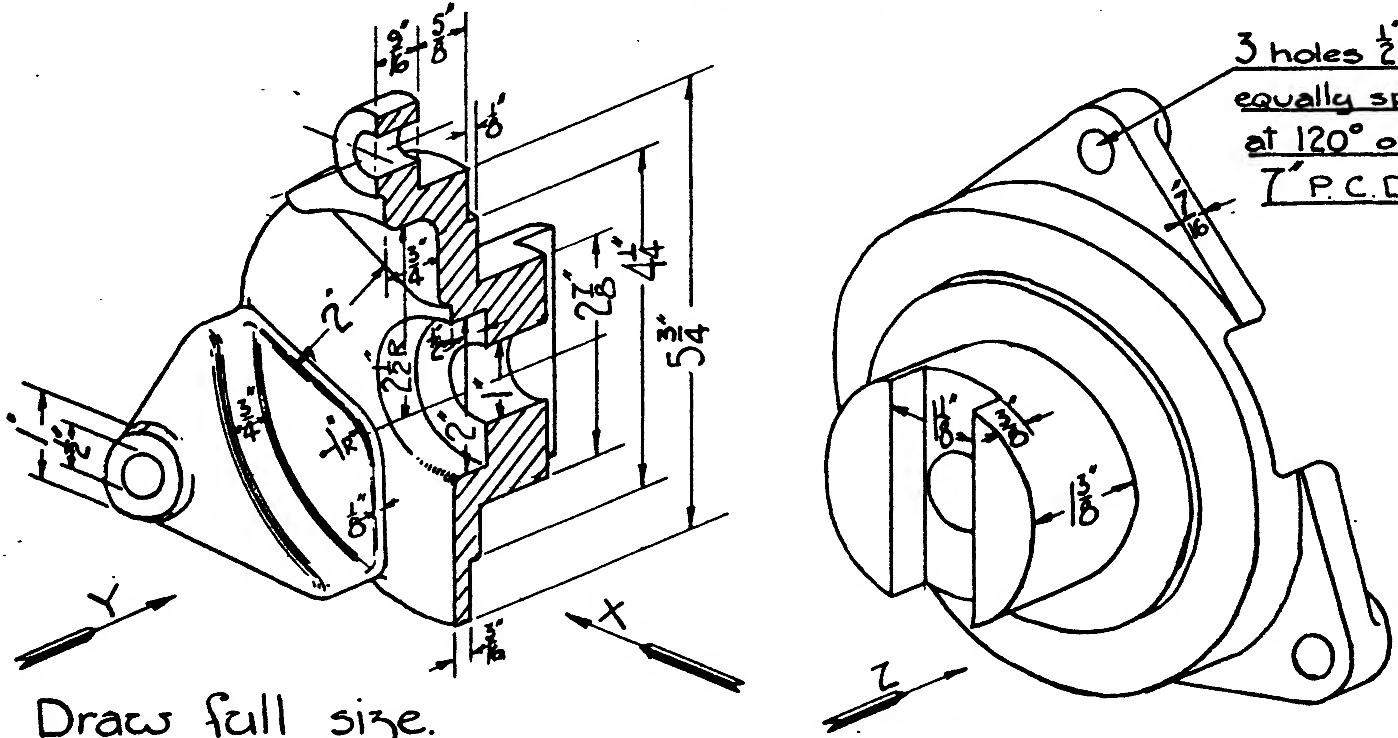


Draw half full size.

1. A front elevation.
2. A sectional end elevation through A - A.
3. A plan projected from front elevation.

CLUTCH COUPLING PART Mild steel.

SHEET No. 6.B.

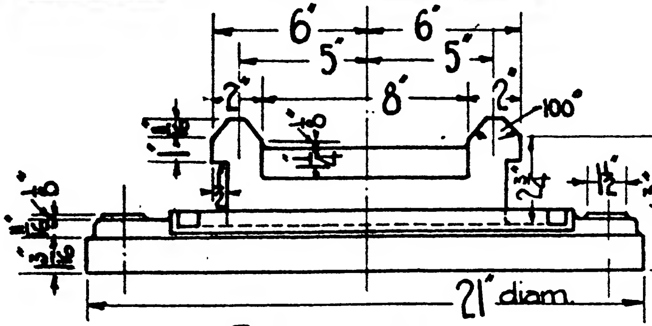


Draw full size.

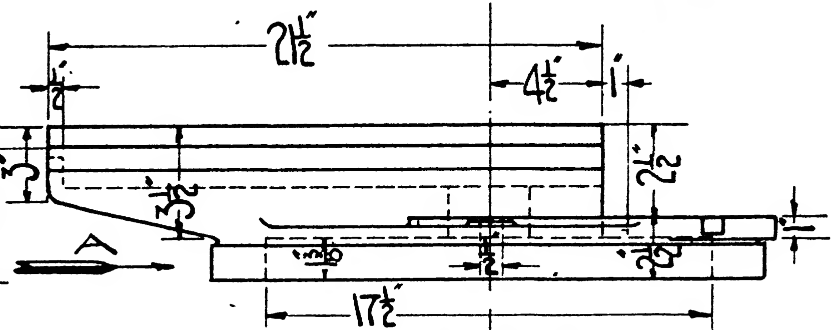
1. A sectional elevation looking X
2. An elevation looking Y
3. An elevation looking Z
4. A plan projected from elevation No3.

SWIVEL SLIDE Cast iron.

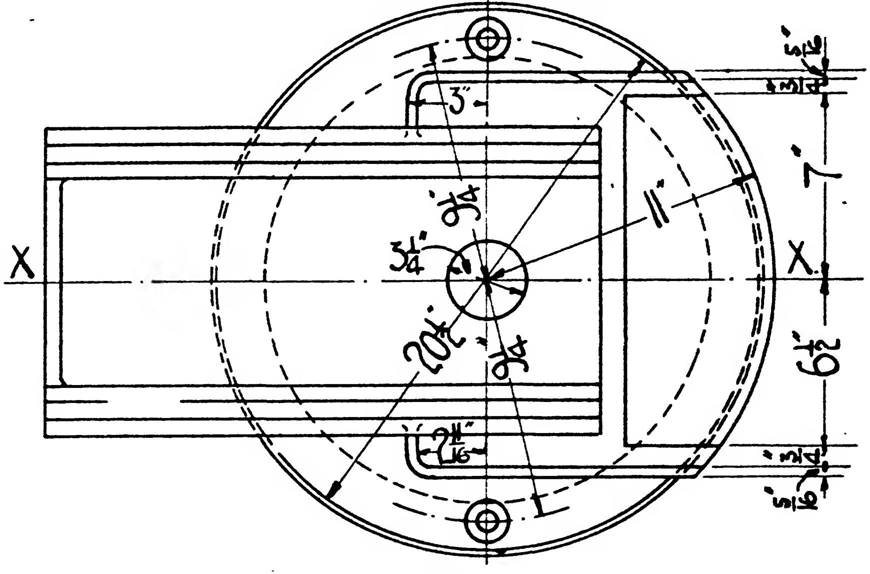
SHEET No. 7B.



End elevation.



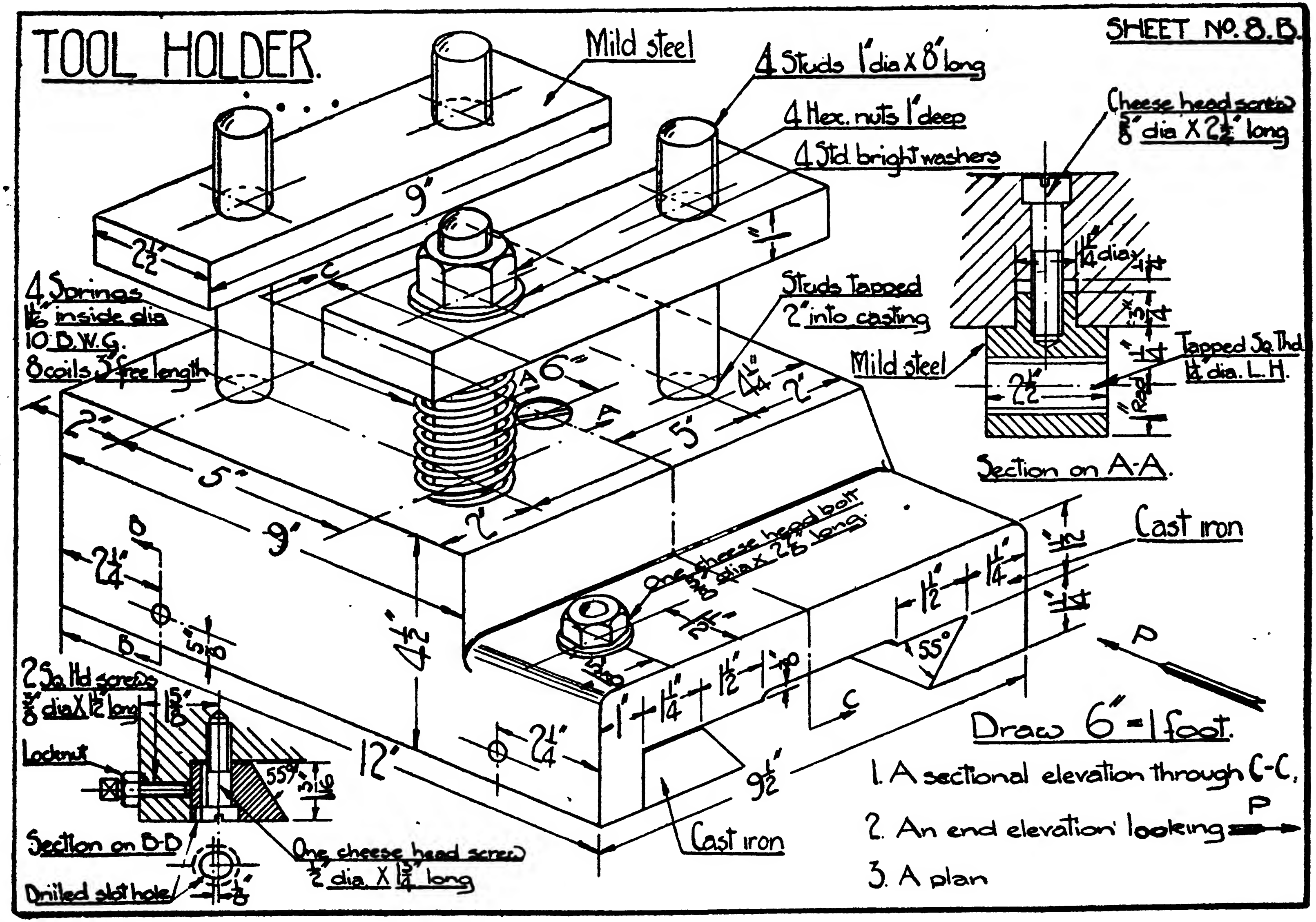
Front elevation

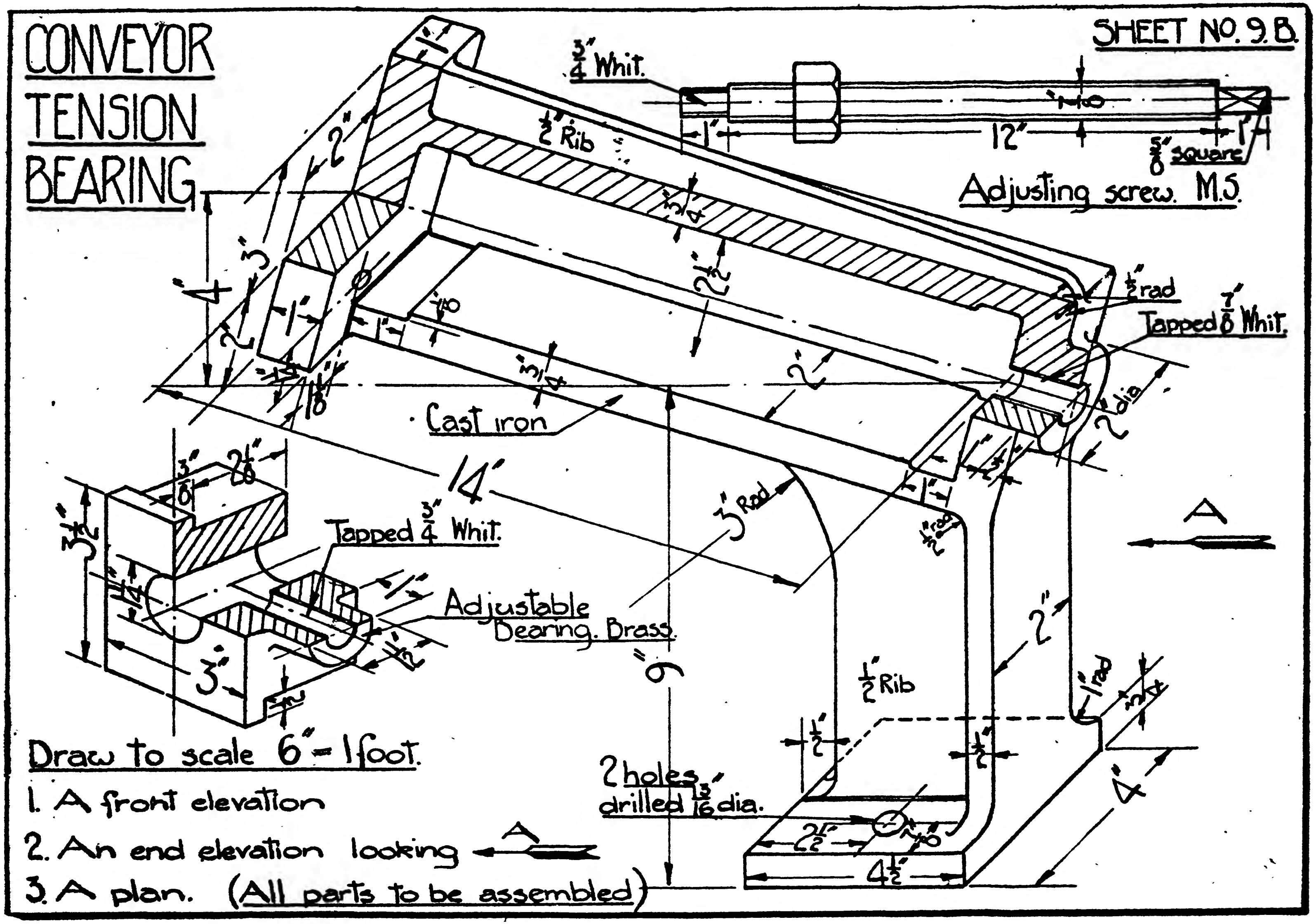


Plan

Draw to scale of 4½" = 1 foot

1. A sectional front elevation through X-X.
2. An end elevation looking A
3. A plan.


TOOL HOLDER.
SHEET No. 8.B.
Mild steel
4 Studs 1" dia x 8" long
4 Hex. nuts 1" deep
4 Std. bright washers
Cheese head screw 3/8" dia X 2 1/4" long
4 Springs 1 1/16" inside dia 10 B.W.G. 8 coils 3" free length
Studs Tapped 2" into casting
Mild steel
Tapped Sq. Thd. 1 1/4" dia. L.H.
Section on A-A.
Cast iron
One cheese head bolt 5/8" dia x 2 5/8" long
2 Sq. Hd screws 3/8" dia X 1 1/2" long
Locknut
Section on B-D
Drilled slot hole
One cheese head screw 1/2" dia. X 1 3/4" long
Cast iron
Draw 6" = 1 foot.
1. A sectional elevation through C-C,
2. An end elevation looking P
3. A plan

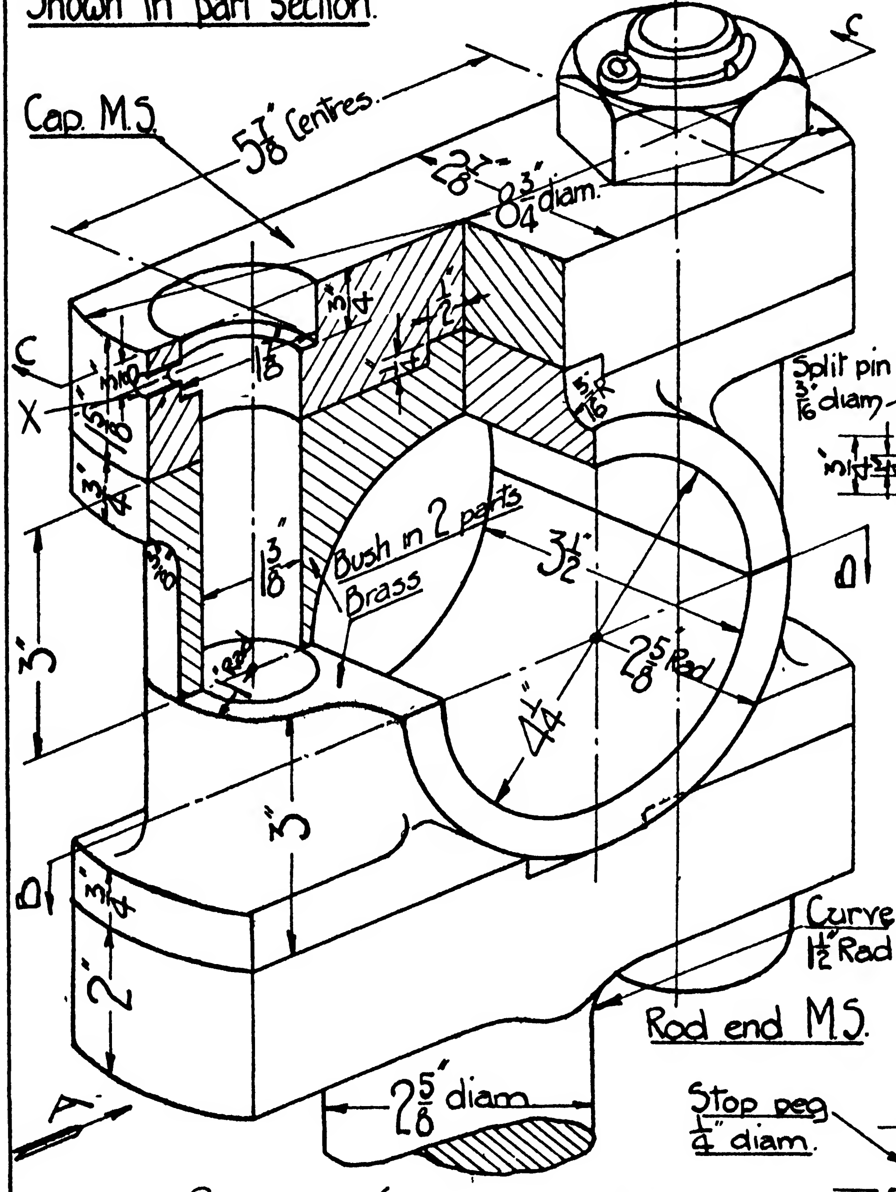


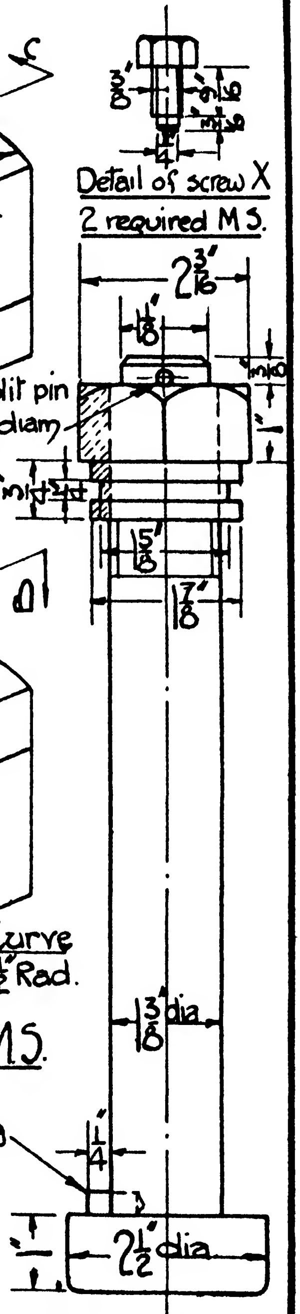
CONVEYOR
TENSION
BEARING
SHEET NO. 9 B.
3/4" Whit.
1/2" Rib
12"
1"
1"
1/4"
5/8" square
Adjusting screw. M.S.
1/2" rad
Tapped 7/8" Whit.
2" dia.
Cast iron
14"
3" Rad
Tapped 3/4" Whit.
Adjustable
Bearing. Brass.
1/2" Rib
2 holes
drilled 13/16" dia.
4 1/2"
2 1/2"
4"
Draw to scale 6" = 1 foot.
1. A front elevation
2. An end elevation looking A
3. A plan. (All parts to be assembled)

CONNECTING ROD END MARINE TYPE

SHEET No 10.B

Shown in part section.





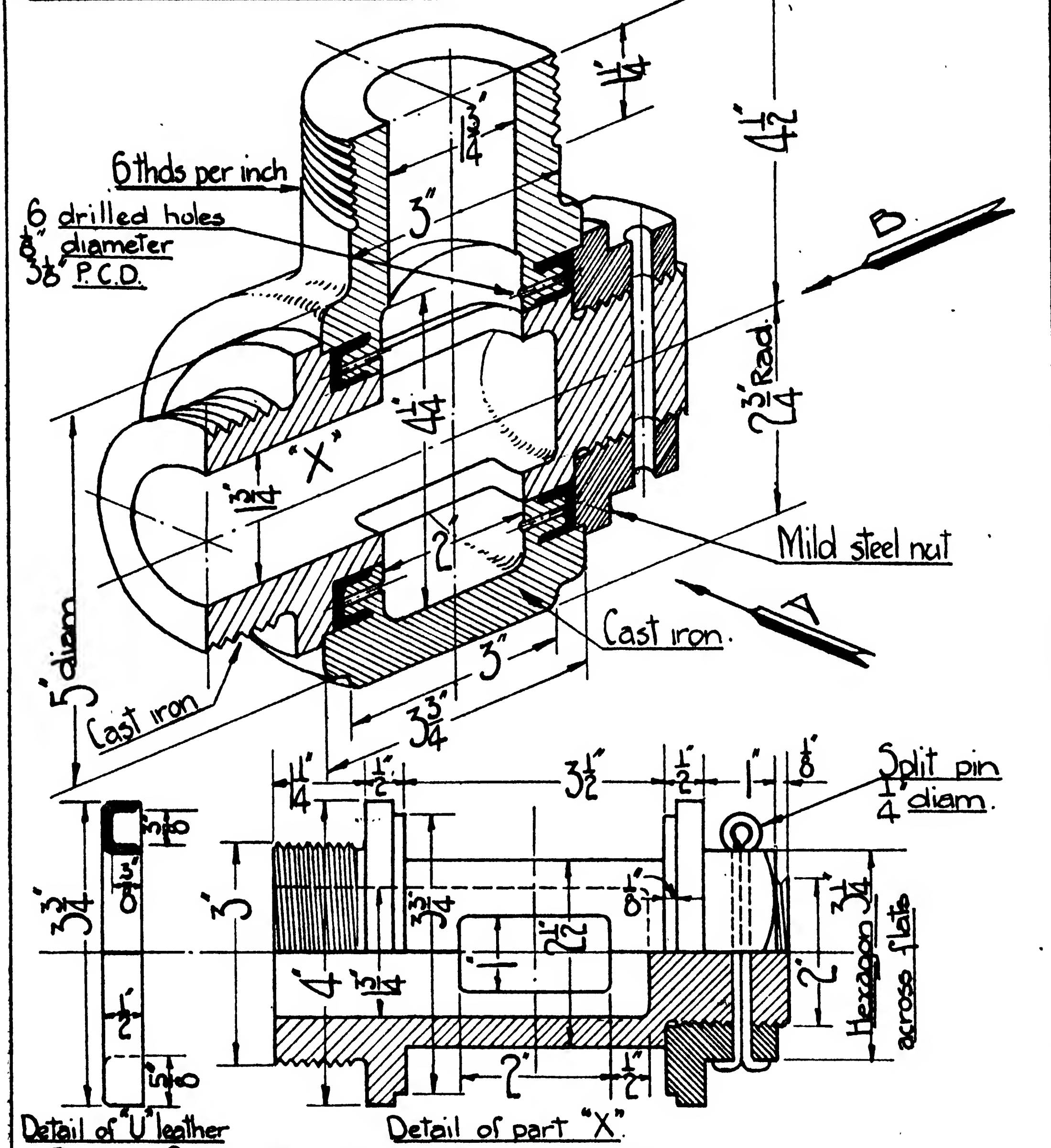
Draw full size. (paper long way up).

1. A front elevation in half section through C-C.
2. An end elevation looking A→
3. A plan in half section through B-B

HYDRAULIC PIVOT JOINT

SHEET No. 11. B.

Shown in half central section.

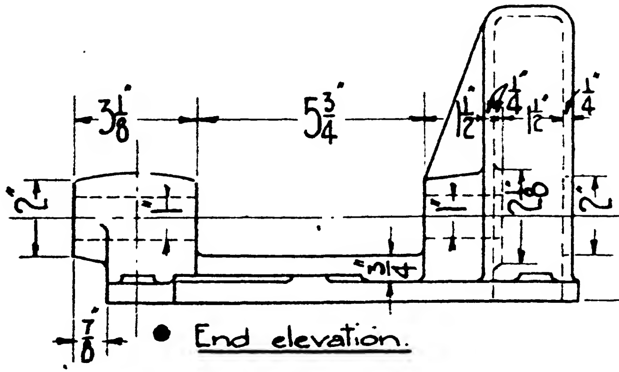


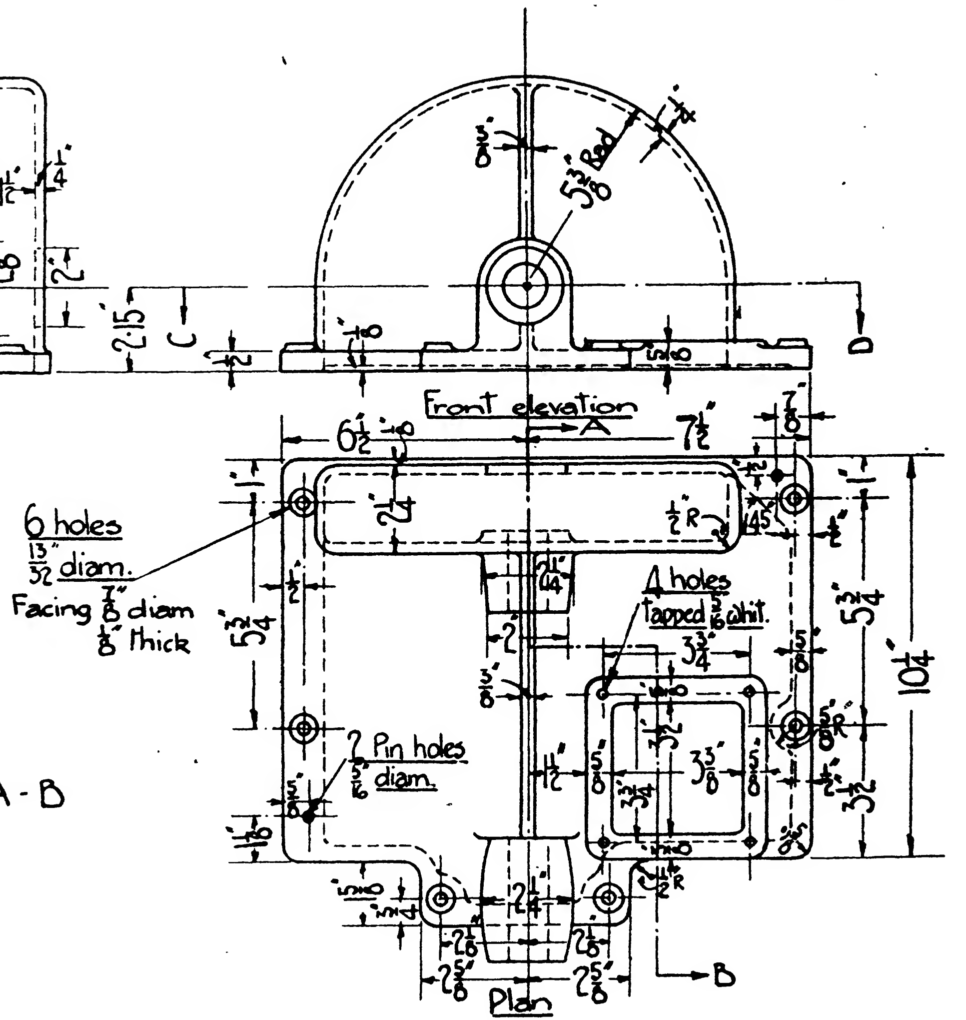
Draw full size with all parts assembled.

1. A front elevation with the left hand half in central section looking A →
2. An end elevation with the left hand half in central section looking B →
3. A complete plan.

GEAR BRACKET Cast iron.

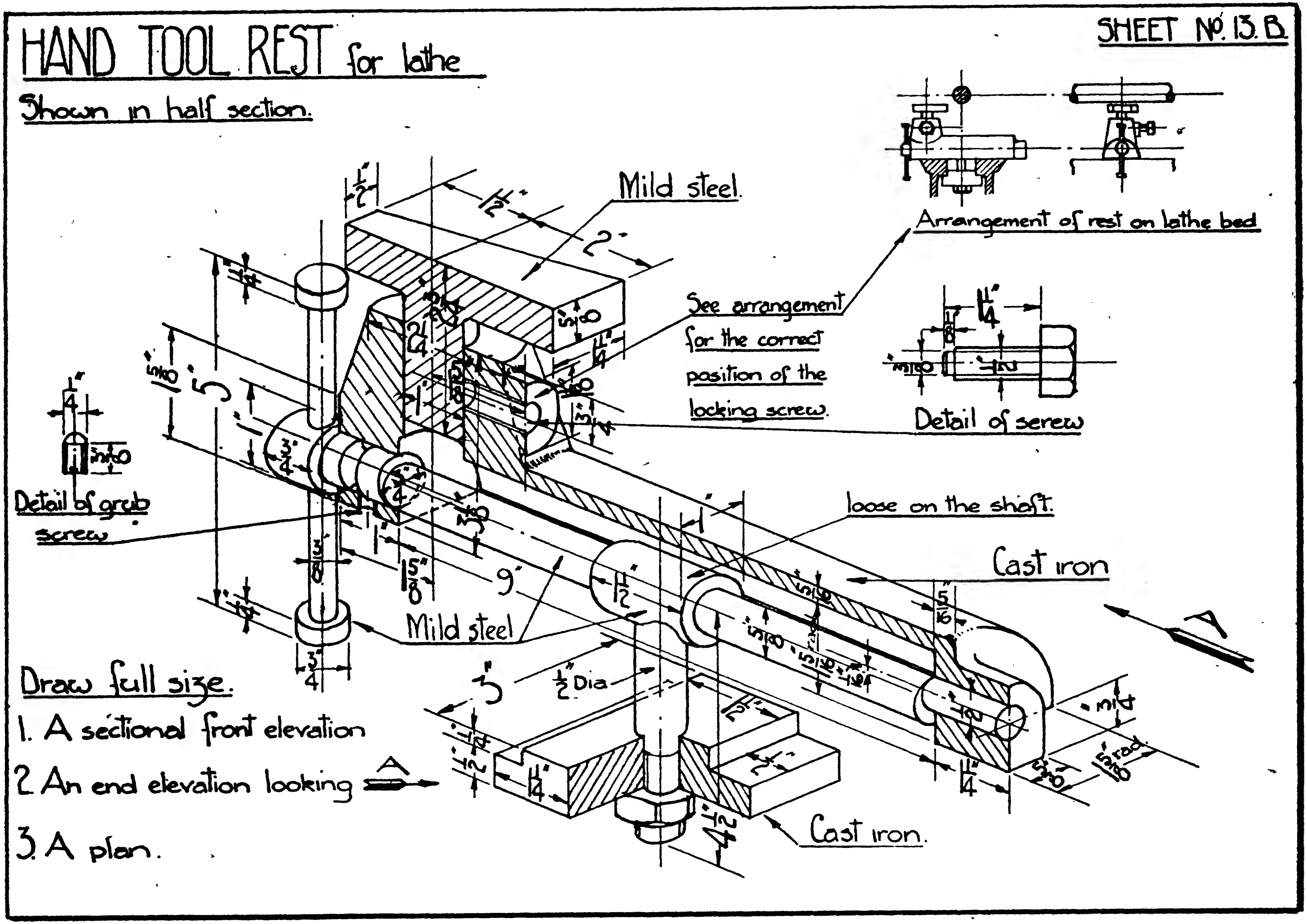
SHEET No. 12.B.





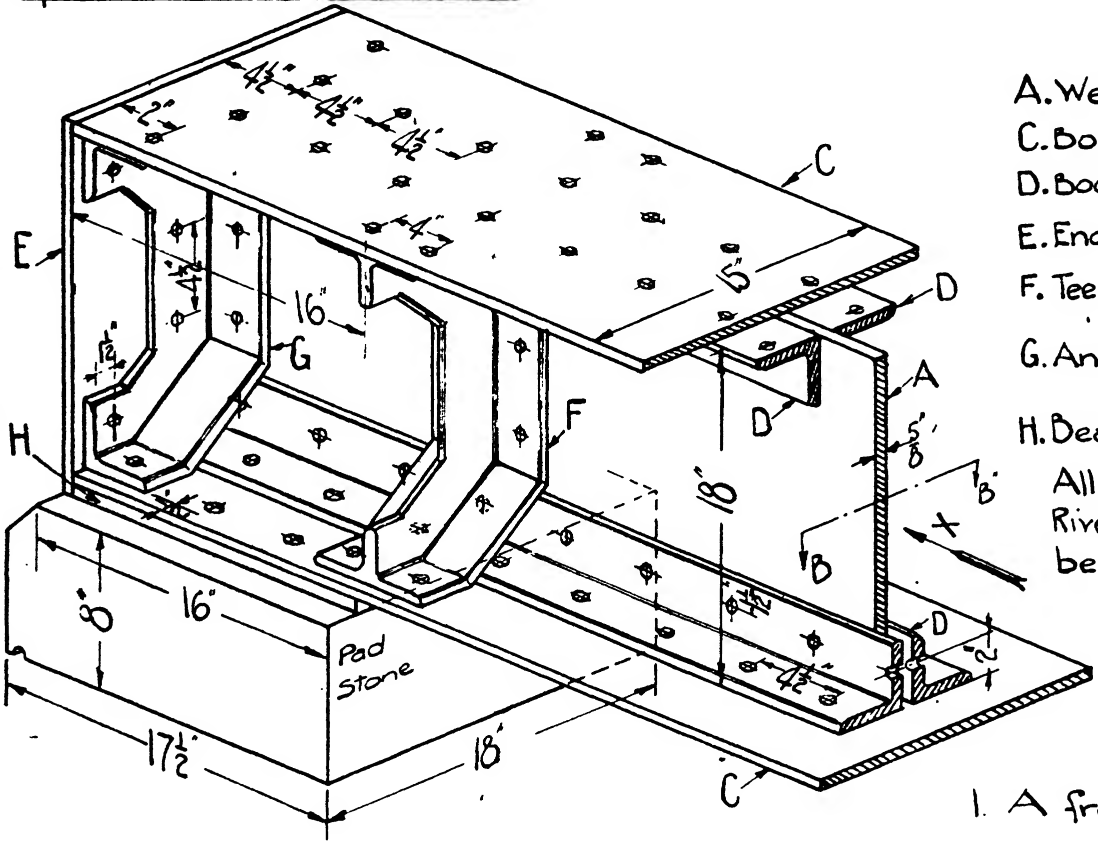
Draw 6" = 1 foot.

1. A front elevation
2. A sectional end elevation through A - B
3. A sectional plan through C - D.


HAND TOOL REST for lathe
Shown in half section.
SHEET No. 13. B.
Mild steel.
See arrangement for the correct position of the locking screw.
Arrangement of rest on lathe bed
Detail of screw
Detail of grub screw
loose on the shaft.
Cast iron
Mild steel
Cast iron.
Draw full size.
1. A sectional front elevation
2. An end elevation looking A
3. A plan.

GIRDER END. Mild steel

SHEET No. 14B.



DATA

A. Web plate ⅝" thick

C. Boom plates ⅜" thick

D. Boom angles 3½" x 3½" x ½"

E. End plate ½" thick

F. Tee stiffener 6" x 3" x ½" cranked to avoid angles.

G. Angle stiffener 3½" x 3½" x ½" cranked to avoid angles.

H. Bearing plate ⅝" thick

All rivets ⅞" dia.

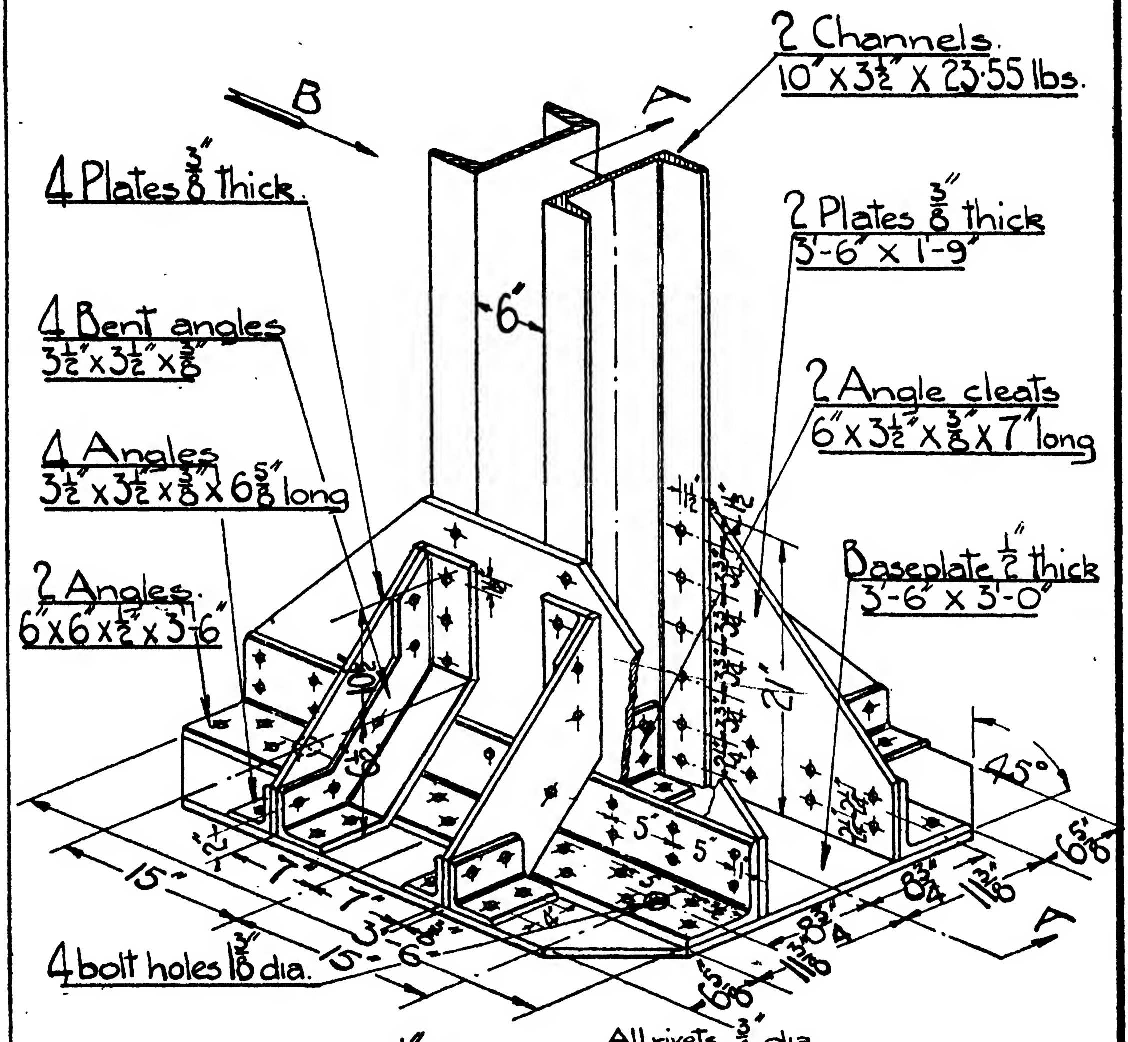
Rivets to rest on stone pad to be csk on the underside.

Draw 3" = 1 foot

1. A front elevation
2. An end elevation looking X →
3. A sectional plan through B-B.

STANCHION BASE. Mild steel.

SHEET No. 15. B.



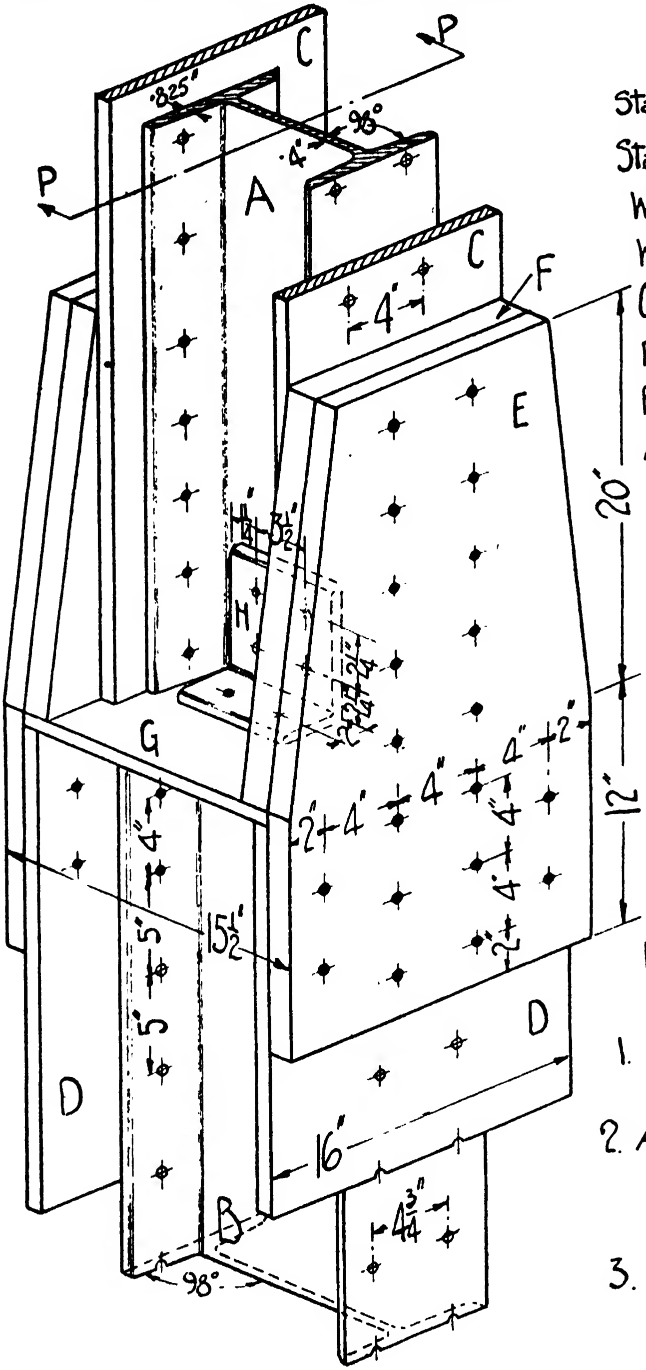
Draw to scale 1½" = 1 foot.

All rivets ¾" dia.
Rivets in baseplate to be c's'k.

1. A front elevation in half section through A-A
2. An end elevation looking B
3. A plan.

STANCHION CONNECTION. Mild steel.

SHEET No. 16B



DATA

Stanchion A 9" x 7" x 50 lbs.

Stanchion B 12" x 8" x 65 lbs.

Web-plates C 12" x $\frac{3}{4}$" thick.

Web plates D. 16" x $\frac{3}{4}$" thick.

Connecting plates E 16" x 32" x 1" thick.

Packing plates F 16" x 20" x $1\frac{1}{2}$" thick.

End plate G. $13\frac{1}{2}$" x 16" x $\frac{3}{4}$" thick.

4 Angle cleats H 6" x $3\frac{1}{2}$" x $\frac{3}{8}$" x 6" long.

All bolts and rivets $\frac{3}{4}$" dia

Bolts shown ●

Rivets shown. ○

Draw. 3" = 1 foot.

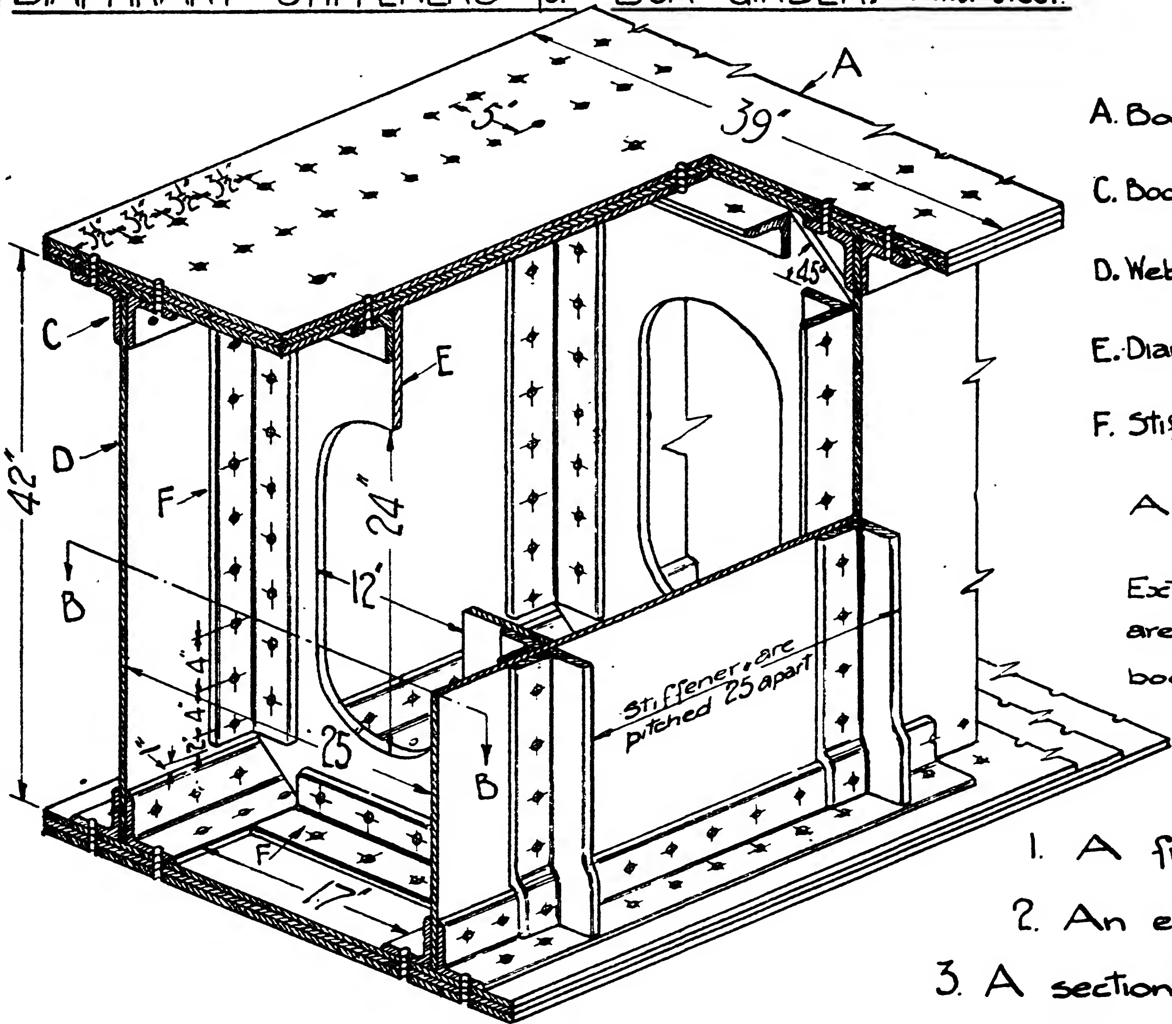
1. A front elevation

2. A sectional end elevation through P-P.

3. A plan.

DIAPHRAM STIFFENERS for BOX GIRDER. Mild steel.

SHEET No. 17 B.



DATA

A. Boom plates 39" wide X ½" thick

C. Boom angles 4" X 4" X ½"

D. Web plates 42" wide X ½" thick

E. Diaphram plates 42" X 25" X ½" thick

F. Stiffener angles 3½" X 3½" X ½"

All rivets ⅞" dia.

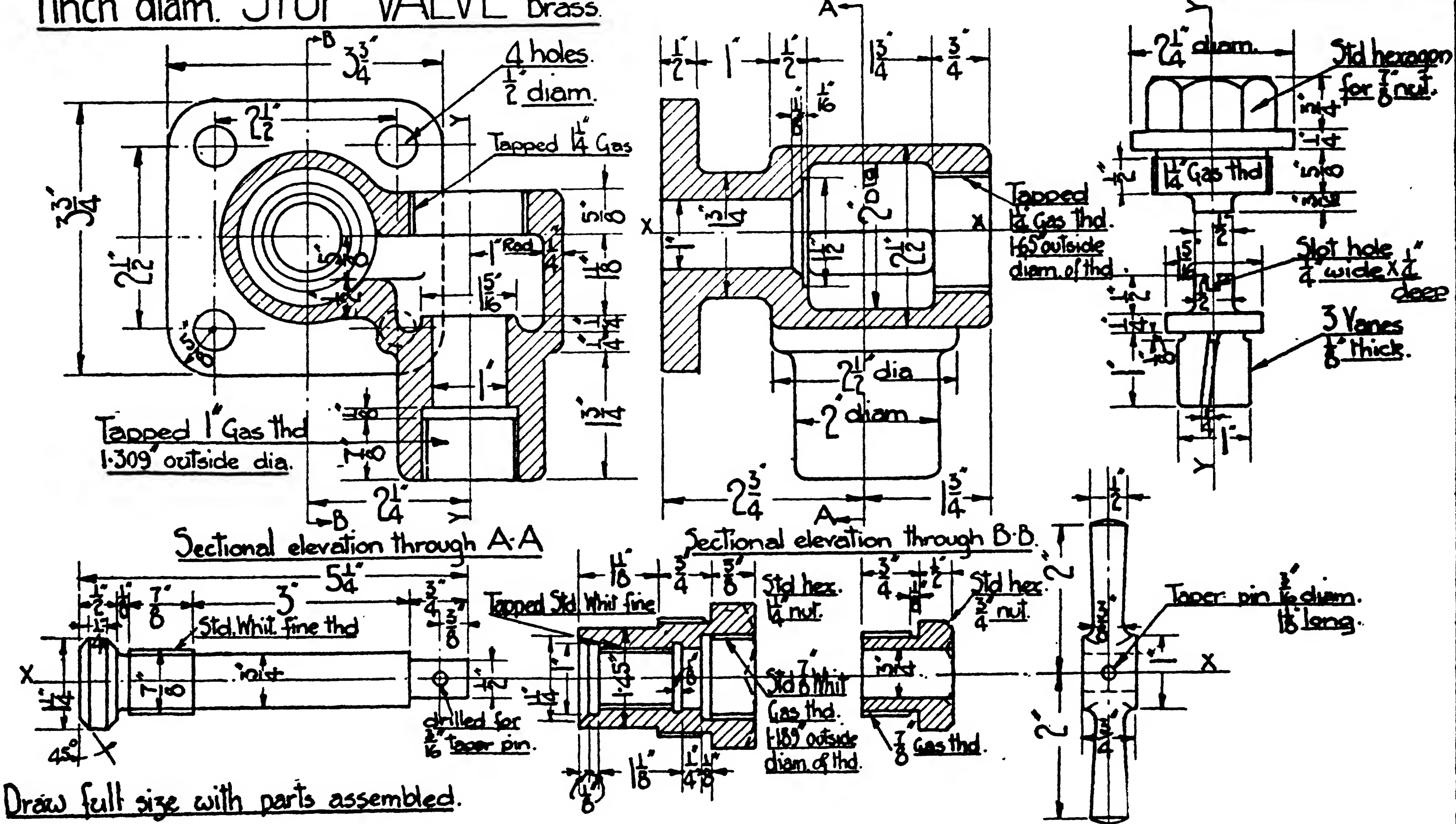
External stiffener angles are joggled to avoid the boom angles.

Draw 1½" = 1 foot.

1. A front elevation.
2. An end elevation.
3. A sectional plan thro' B-B

SHEET No. 18. B.

1 inch diam. STOP VALVE Brass.

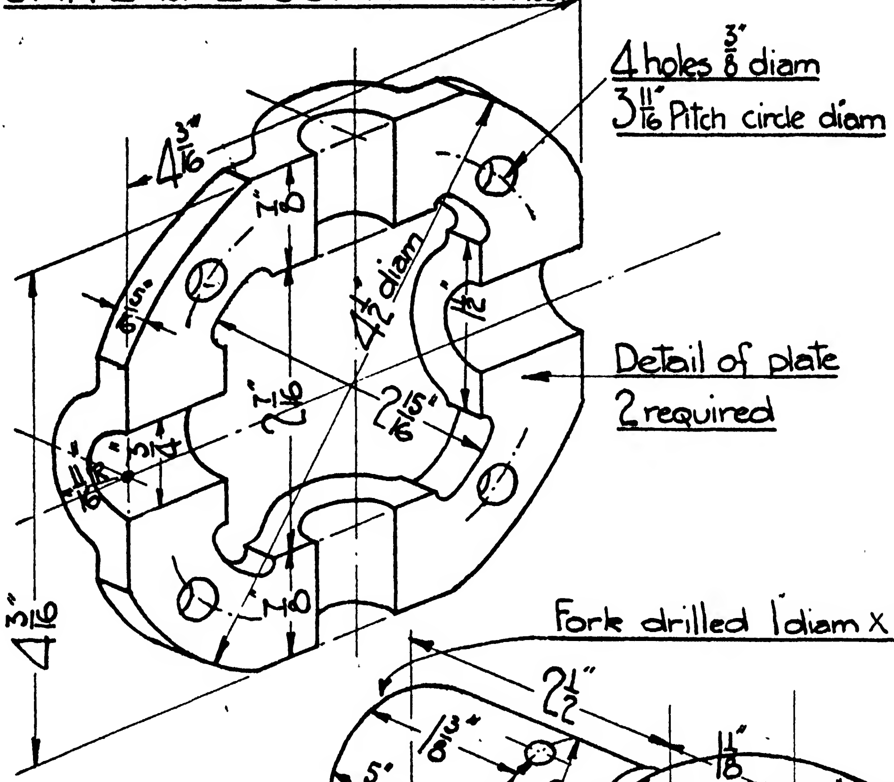


Draw full size with parts assembled.

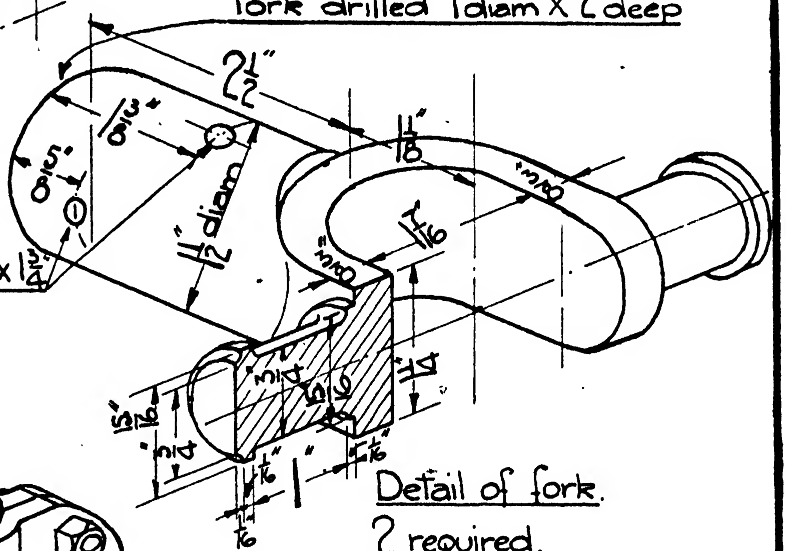
1. A sectional elevation through A-A.
2. A sectional elevation through B·B.
3. A complete plan.

UNIVERSAL JOINT Mild steel

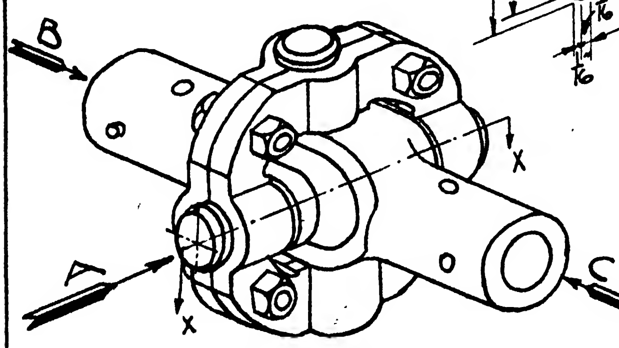
SHEET No. 19B.



Detail of plate
2 required



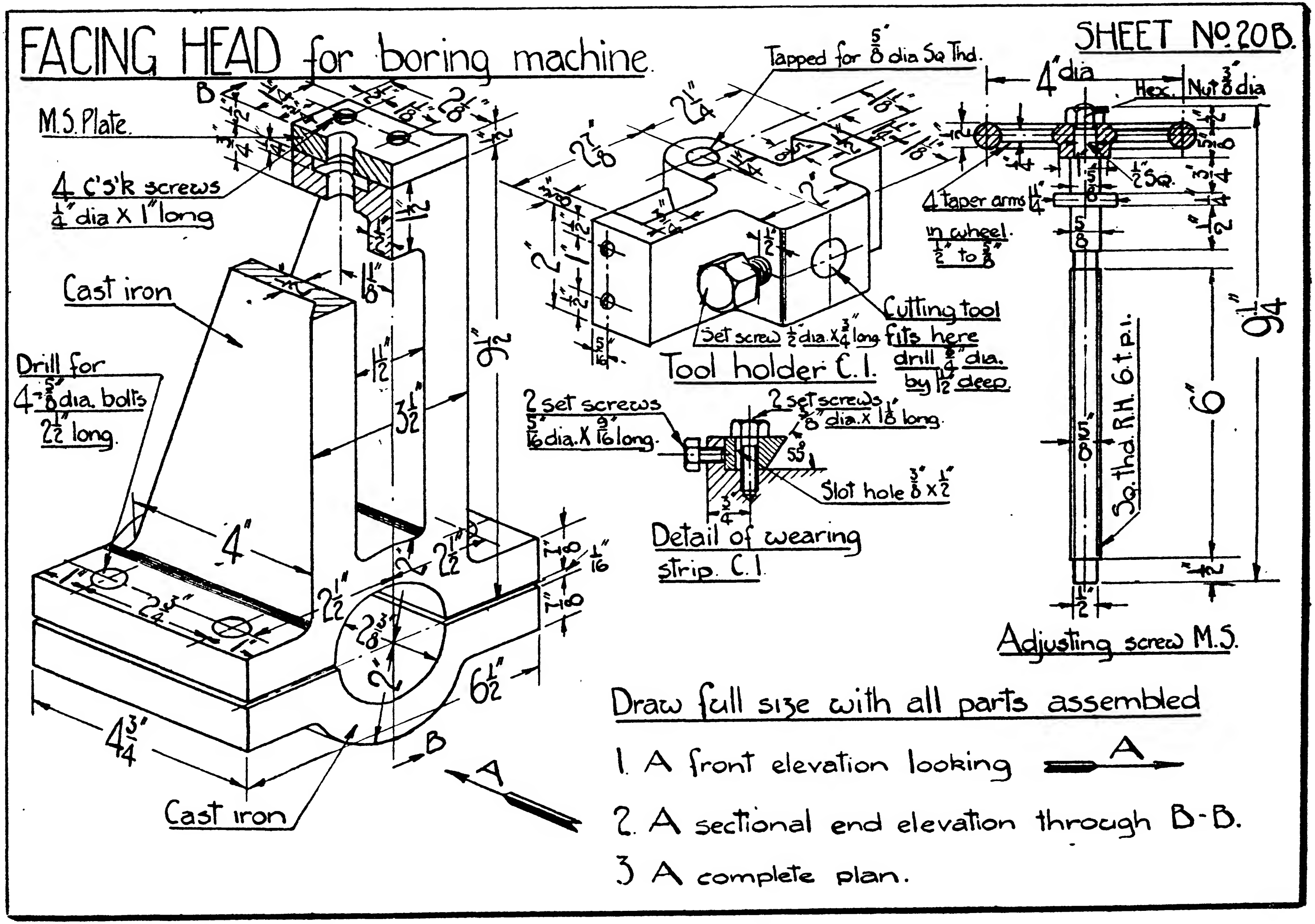
Detail of fork.
2 required.



Arrangement of joint

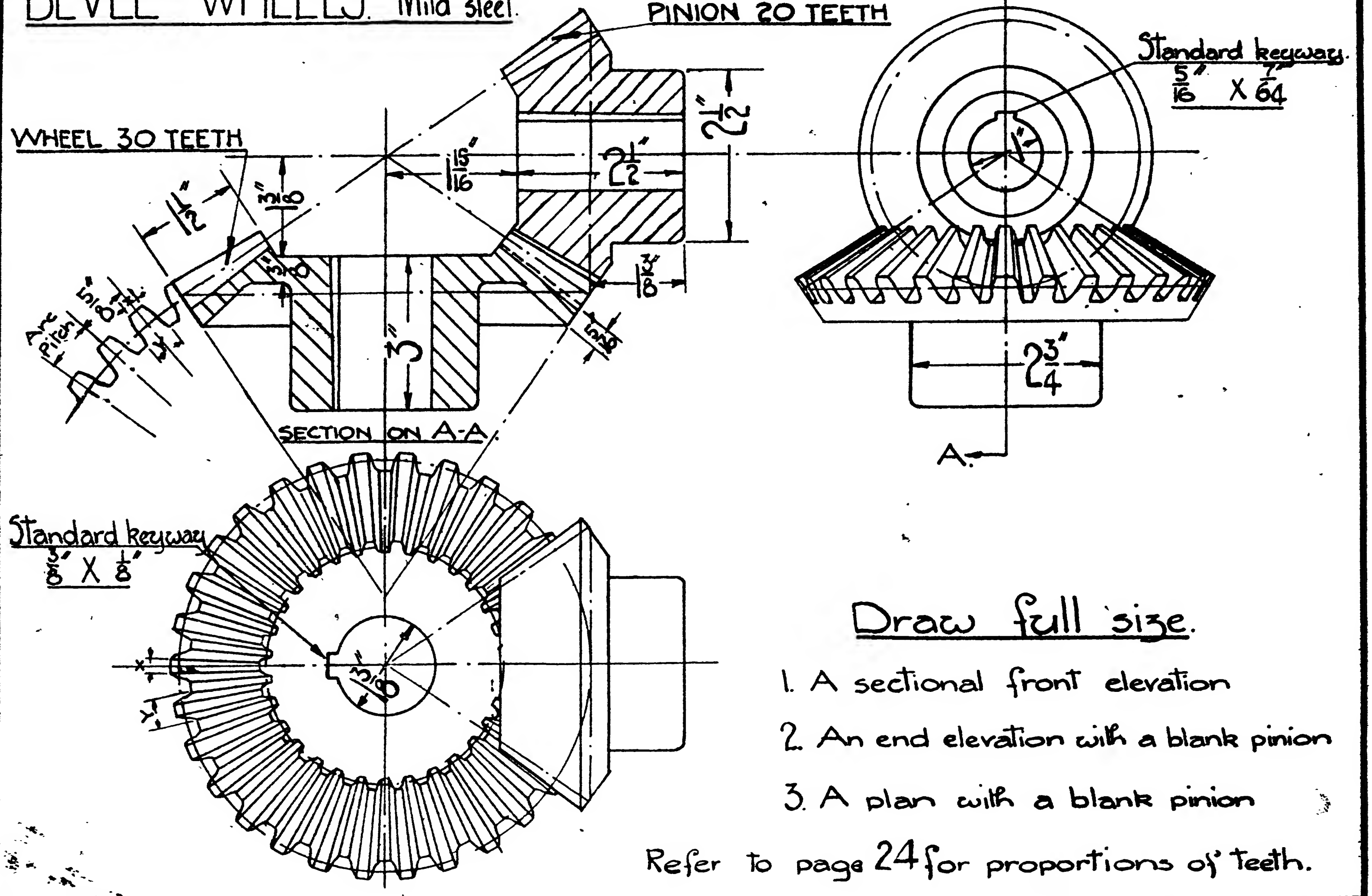
Draw full size.

1. A front elevation looking A →
2. An end elevation looking B →
3. An end elevation looking C → with one plate and fork removed
4. A sectional plan through X–X.


FACING HEAD for boring machine.
SHEET No. 20B.
M.S. Plate.
4 C's'k screws
1/4" dia X 1" long
Cast iron
Drill for
4-5/8" dia. bolts
2 1/2" long.
Cast iron
Tapped for 5/8 dia Sq Thd.
Set screw 1/2 dia. X 3/4 long
Tool holder C.I.
Cutting tool
fits here
drill 3/4" dia.
by 1/2 deep
2 set screws
5/16 dia. X 9/16 long.
2 set screws
3/8" dia. X 1 1/8 long.
Slot hole 3/8 x 1/2
Detail of wearing
strip. C.I.
4" dia
Hex. Nut 3/8 dia
1/2 Sq.
4 taper arms 1/4
in wheel.
1/2 to 3/8
Sq. thd. R.H. 6 t.p.i.
Adjusting screw M.S.
Draw full size with all parts assembled
1. A front elevation looking A
2. A sectional end elevation through B-B.
3 A complete plan.

BEVEL WHEELS. Mild steel.

SHEET No. 21.B.



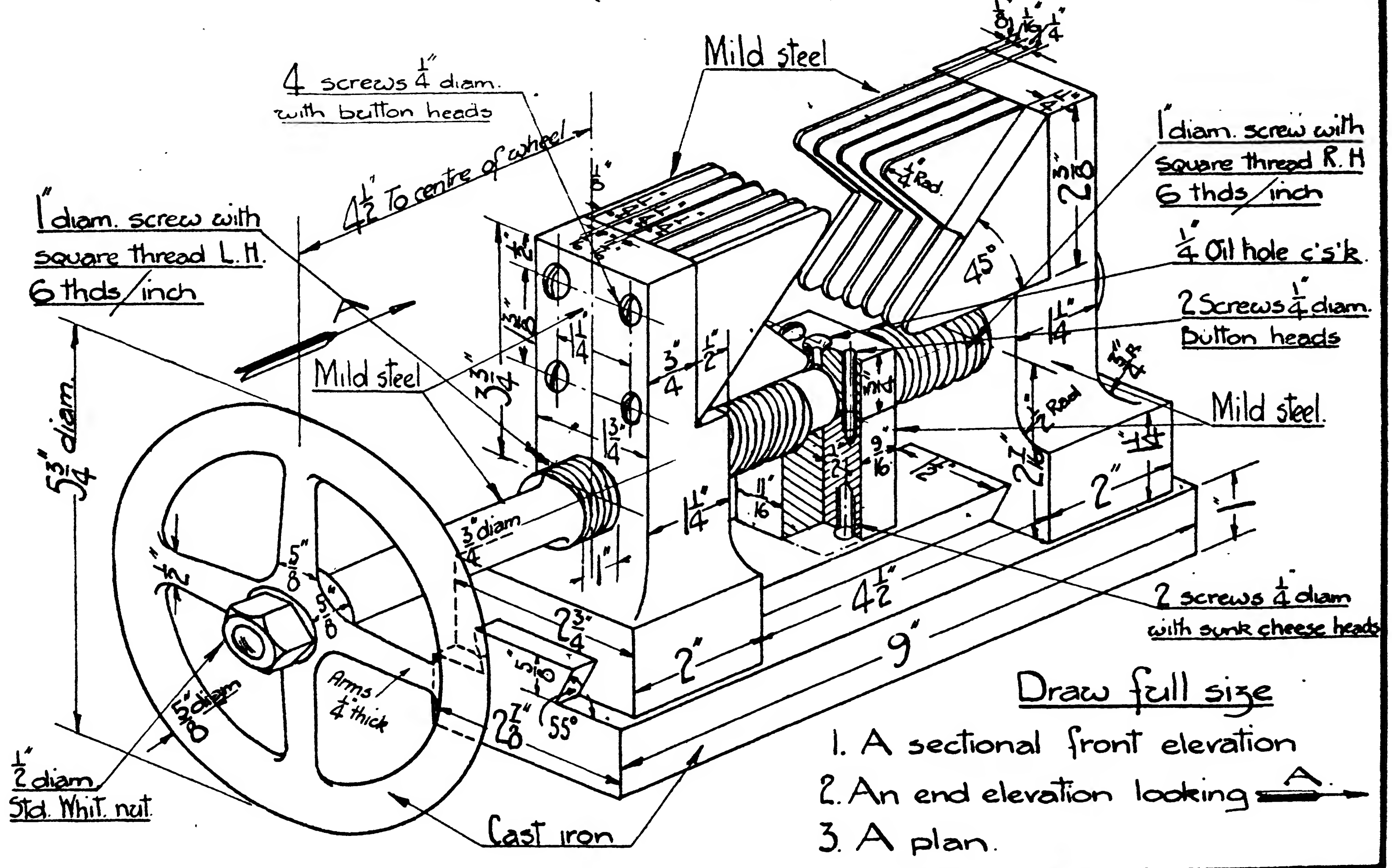
Draw full size.

1. A sectional front elevation
2. An end elevation with a blank pinion
3. A plan with a blank pinion

Refer to page 24 for proportions of teeth.

JAWS for CENTRING MACHINE

SHEET No. 22B.

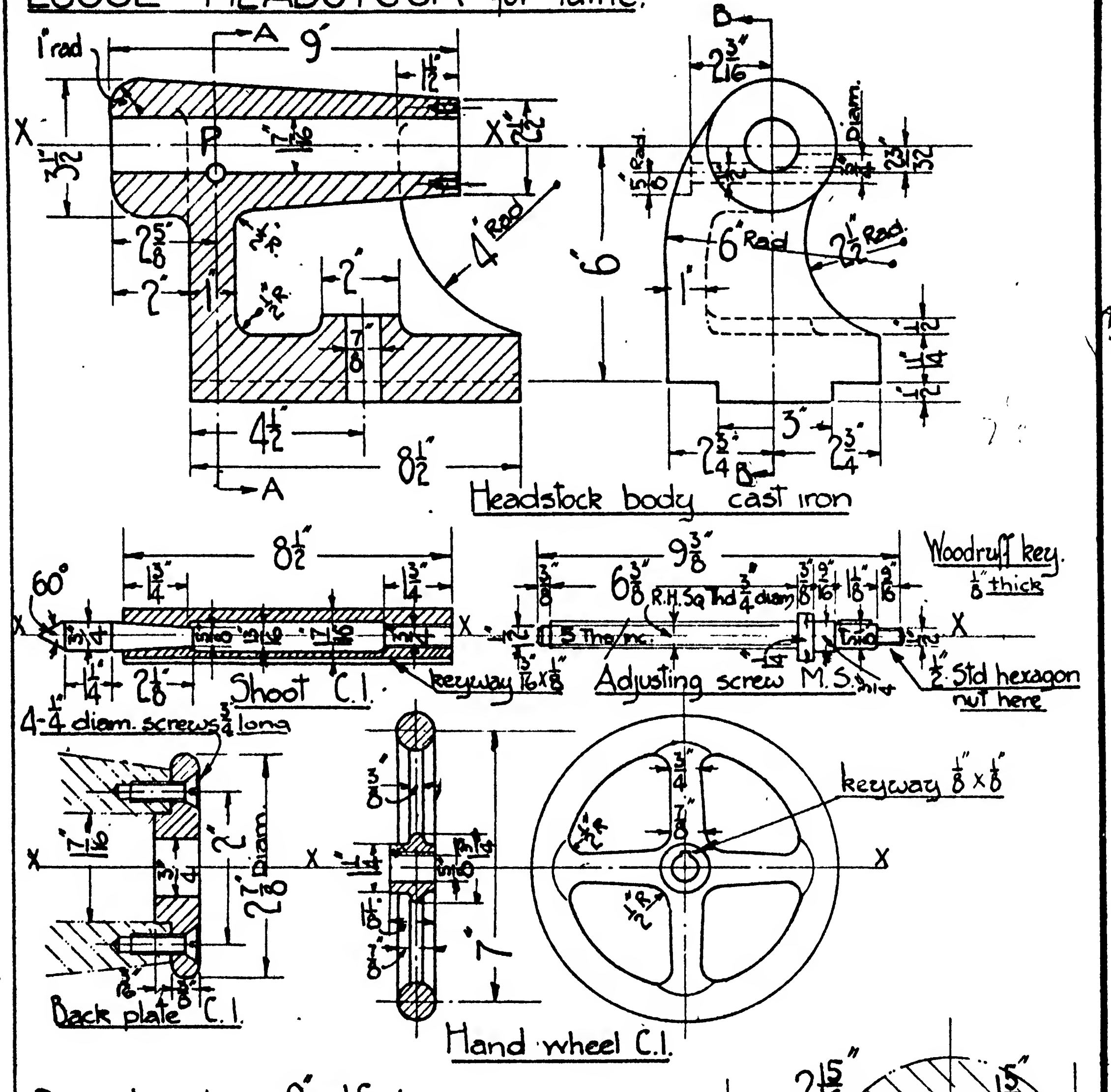


Draw full size

1. A sectional front elevation
2. An end elevation looking A
3. A plan.

LOOSE HEADSTOCK for lathe.

SHEET No. 23B.



Draw to scale of 9" = 1 foot

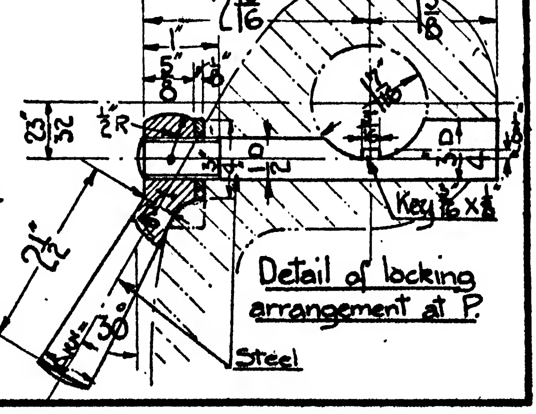
with all the parts assembled.

Note:- X is the common centre line.

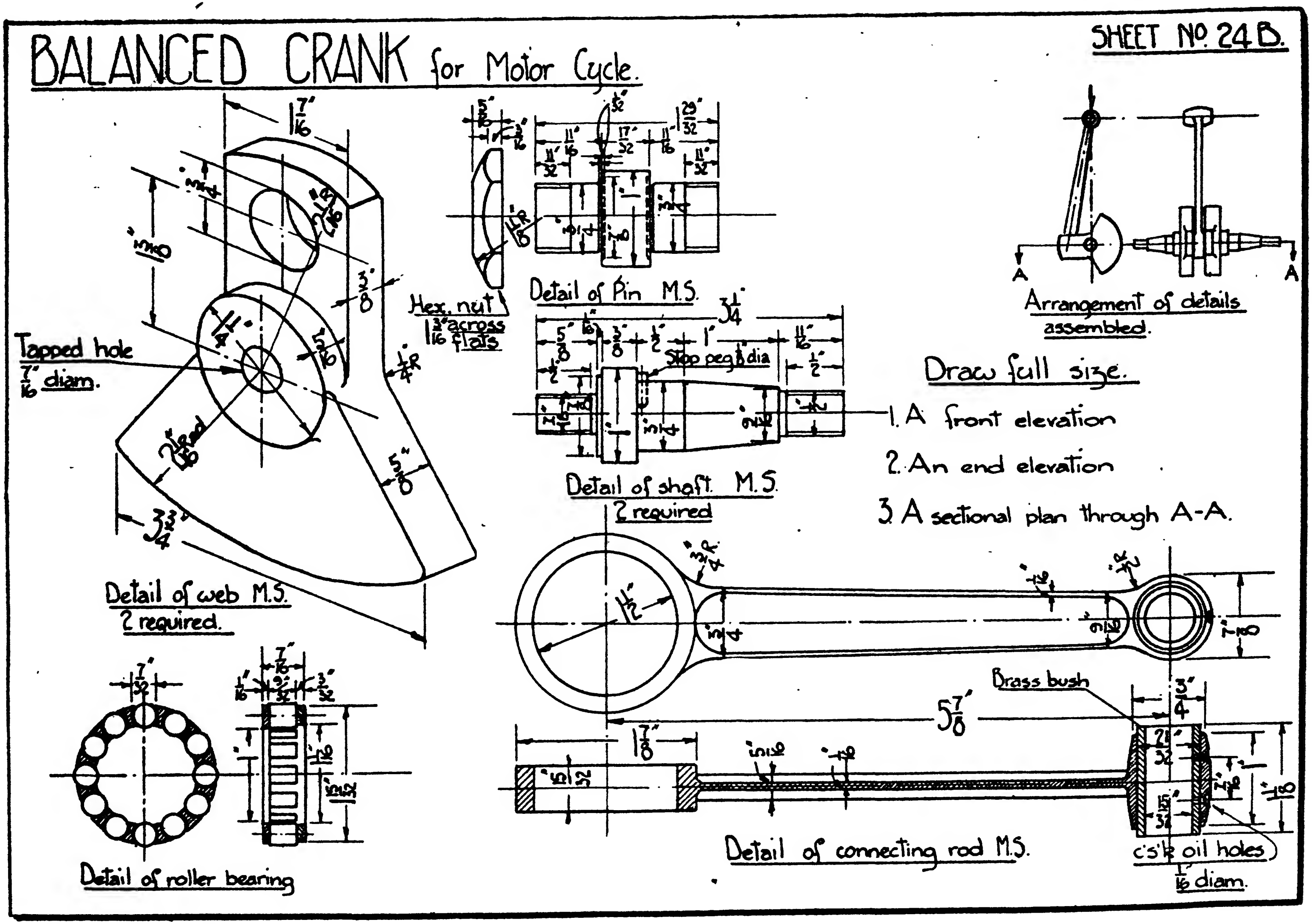
1. A sectional front elevation through B-B.

2. A sectional end elevation through A-A

3. A plan without handwheel.

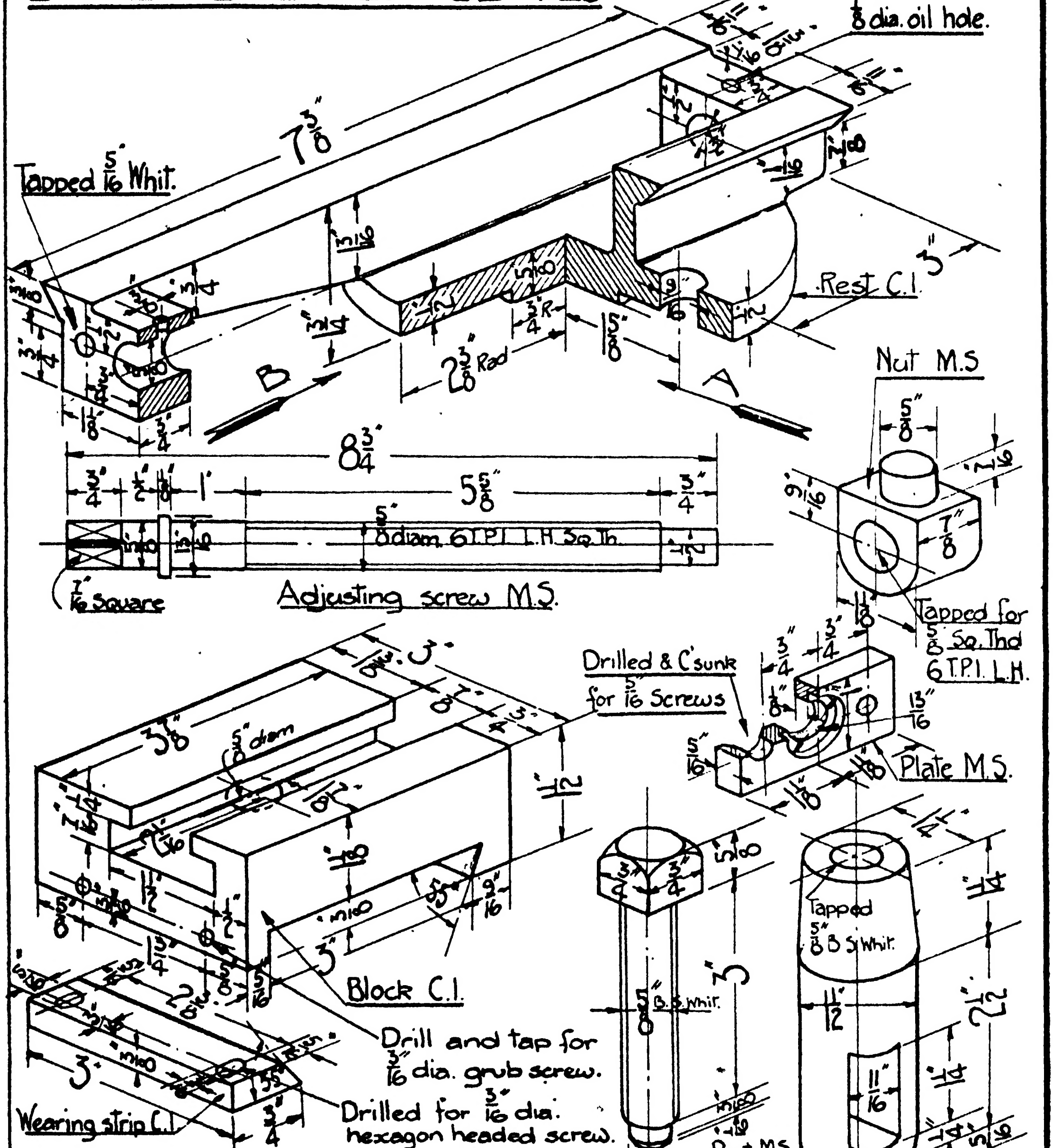


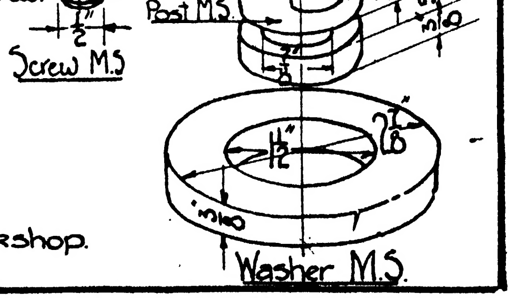
Detail of locking arrangement at P.


BALANCED CRANK for Motor Cycle.
SHEET No. 24 B.
Tapped hole 7/16" diam.
Detail of web M.S.
2 required.
Hex. nut 1 3/16" across flats
Detail of Pin M.S.
Stop peg 1/8 dia
Detail of shaft M.S.
2 required
Arrangement of details assembled.
Draw full size.
1. A front elevation
2. An end elevation
3. A sectional plan through A-A.
Brass bush
Detail of connecting rod M.S.
c's'k oil holes 1/16 diam.
Detail of roller bearing

LATHE SLIDE REST DETAILS

SHEET No. 25 B





Draw full size.

Sufficient views of each part to show all dimensions so that the drawing is suitable for the workshop.

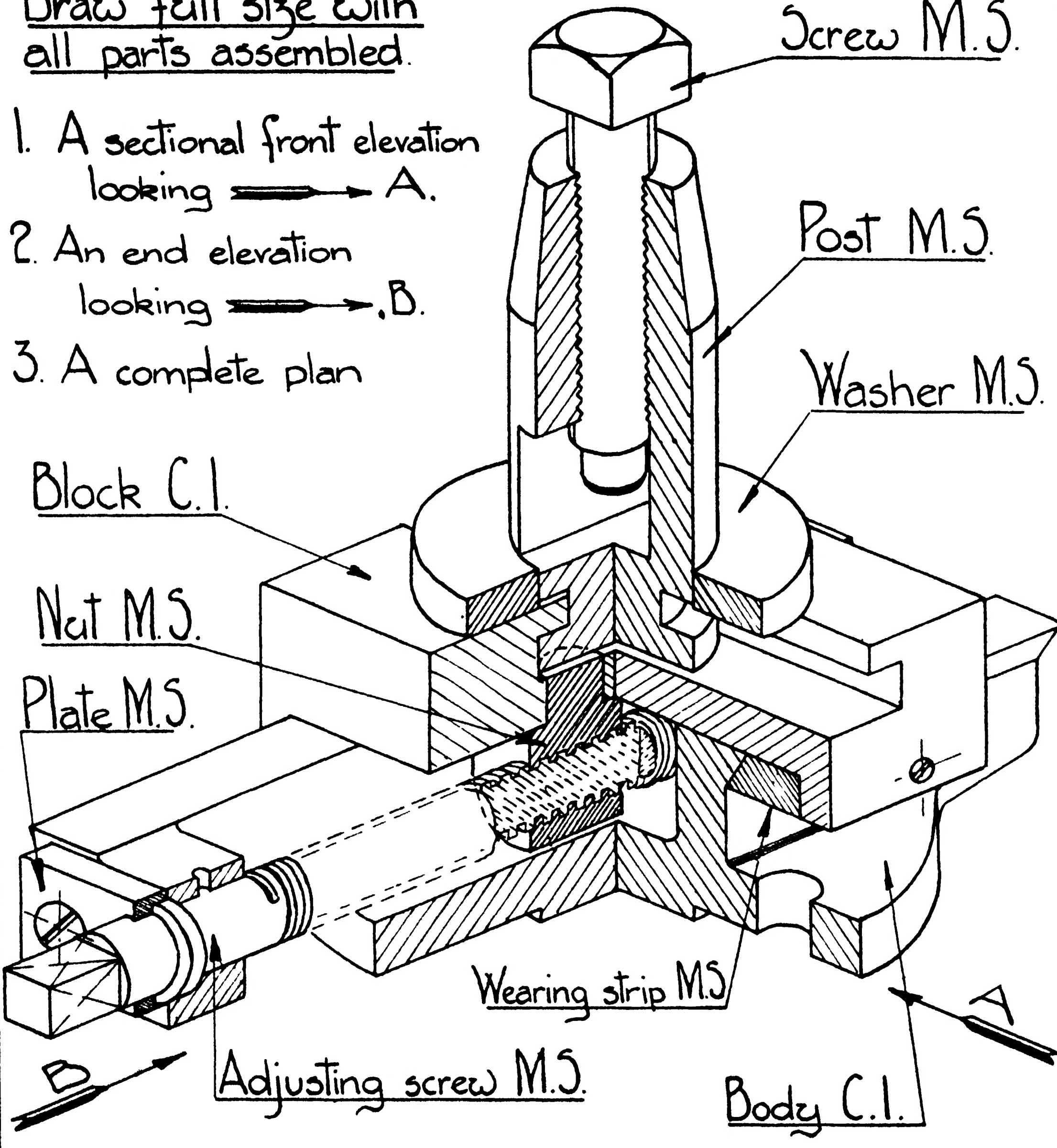
LATHE SLIDE REST.

SHEET Nº 26.B.

Arrangement shown in quarter section.

Draw full size with all parts assembled.

1. A sectional front elevation looking ⟶ A.
2. An end elevation looking ⟶ B.
3. A complete plan



All dimensions are given on detail sheet Nº 25.B.