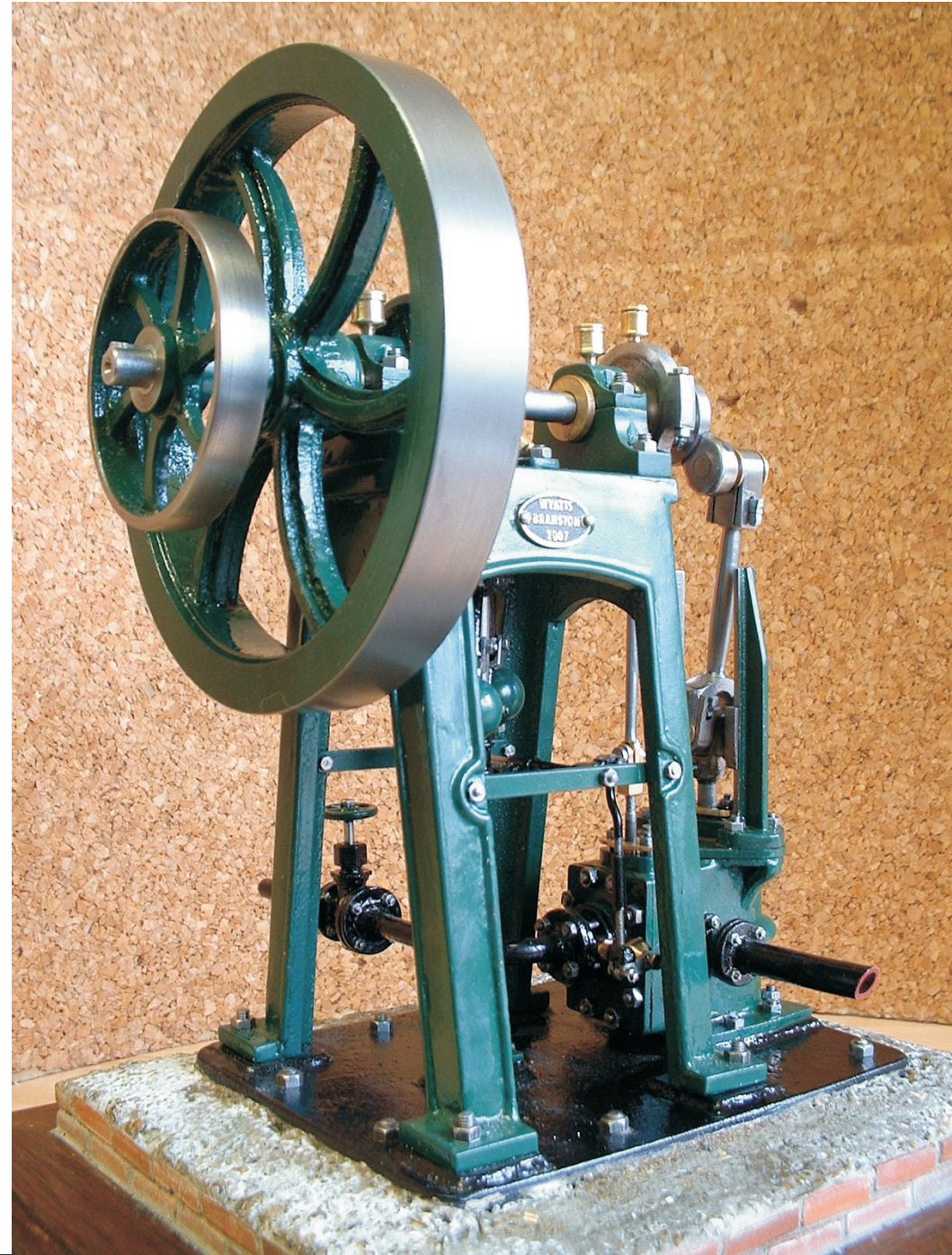
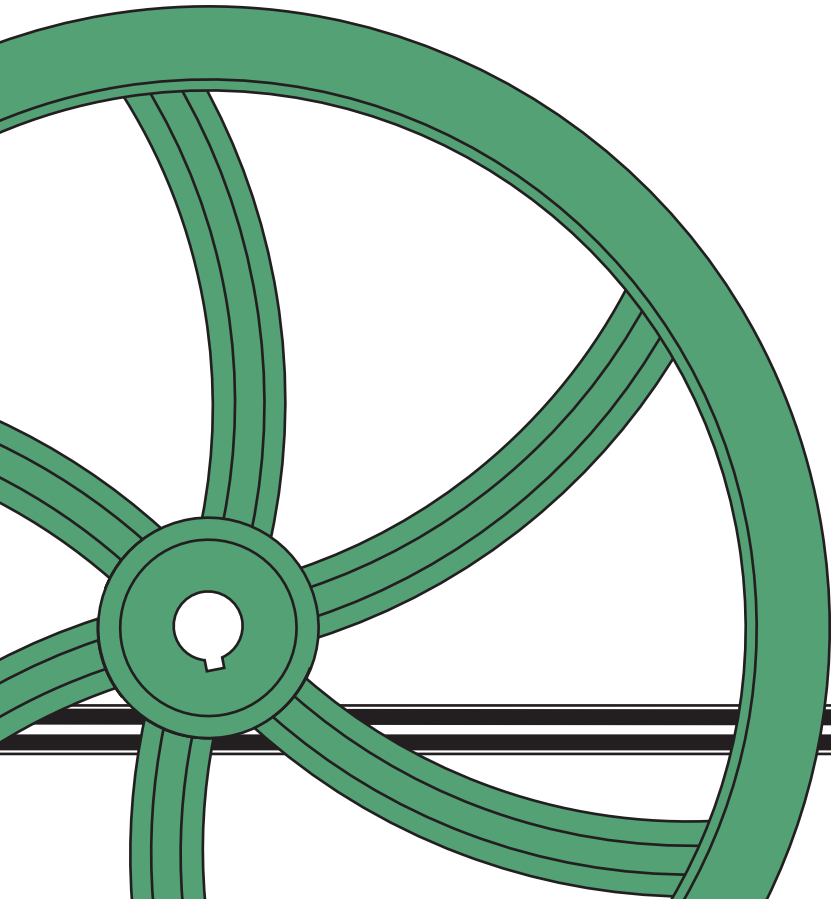


# Norden

A Lancashire Mill Engine

Scale: 1:12



# Norden

A Lancashire Mill Engine

## General Arrangement

Scale: 1:12 1st Angle Projection

Date: 02/2009

Sheet: 1

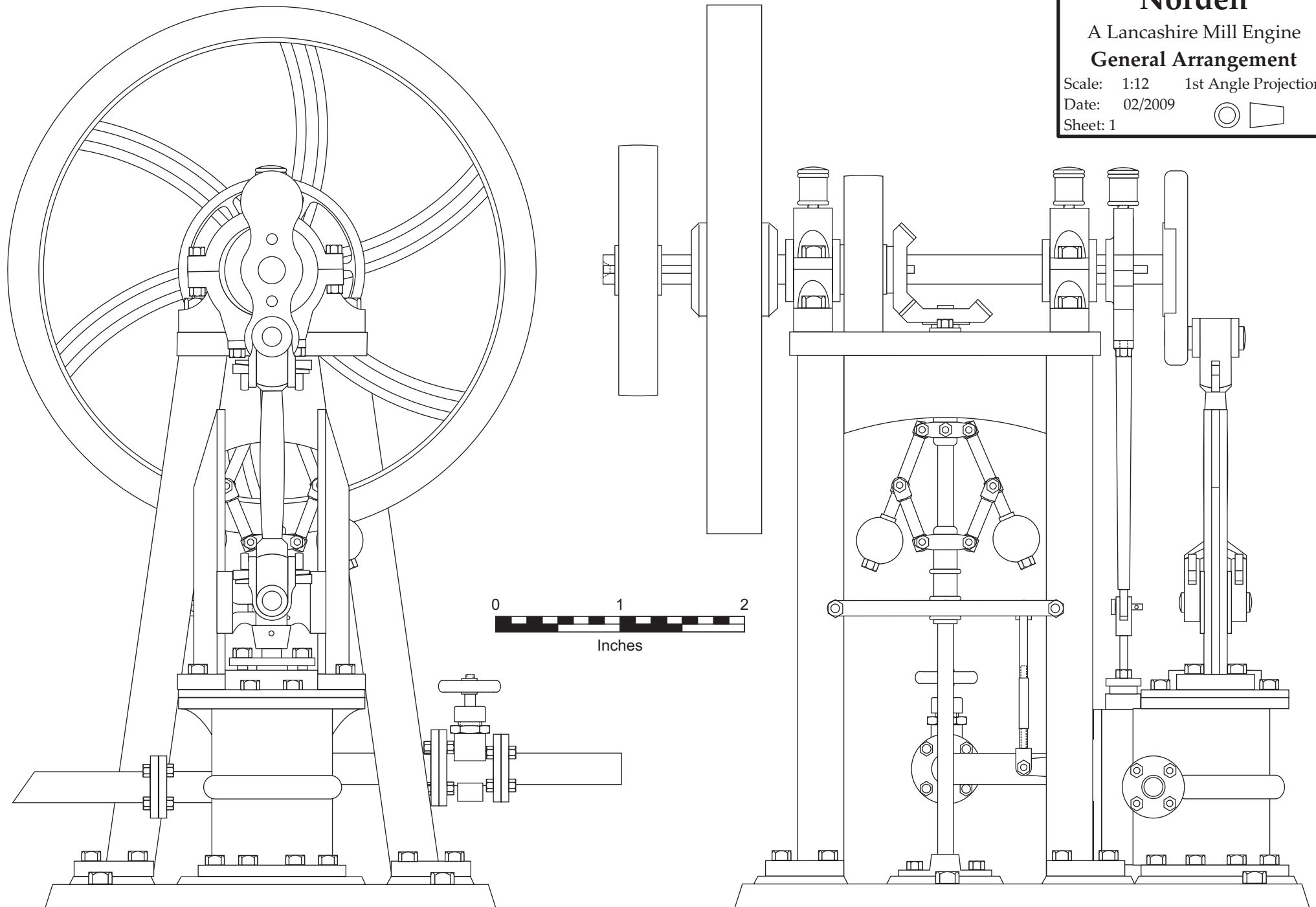


Fig. 1: General Arrangement

## An Old Steam Engine

DEAR SIR, — In the ruins of an old mill at Norden, near Rochdale, there is an old steam engine which has been left rotting away with five others, and a Lancashire Boiler.

The bed of this engine was like a table, cast with the top and legs in one piece and bolted down to a cast iron bedplate, which in turn is bolted to a slab of concrete. The height of the table is 4 ft. 6 in., and the top of the table measures 2 ft. 4 1/2 in. by 1 ft. 5 1/2 in.

The flywheel is 4 ft. 3 in. diameter by 5 in. face. There are six curved spokes of + section.

The cylinder is bolted direct to the bedplate by its bottom flange. The bore is approximately 9 in. and the stroke is 13 in.

The crosshead is of the alligator-type and runs between locomotive-type slide bars, which are 2 ft. 3 1/2 in. long by 2 1/4 in. wide.

The connecting rod is bellied and has strap and cotter big- and little-ends. The centres of the connecting rod are 2 ft. 1 in.

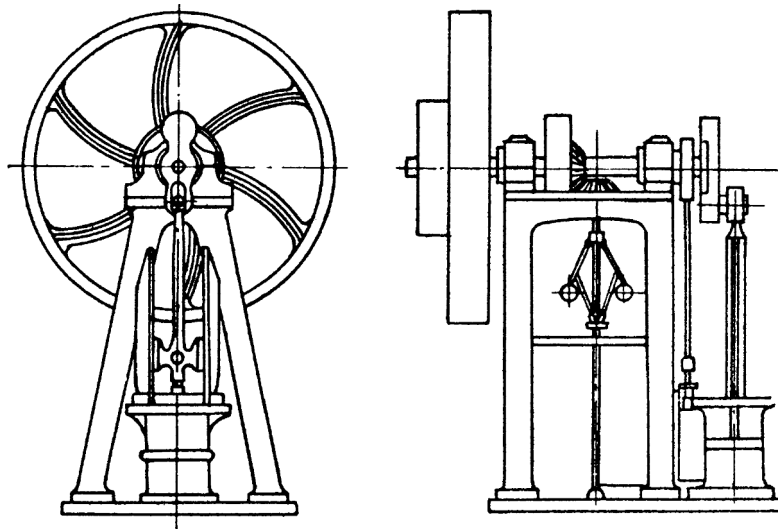
The crankshaft is 2 1/2 in. diameter and rests in two bearings, one at each end of the table ; the single crank web is balanced.

The governor has two 5 in. diameter balls and was driven direct off the crankshaft by bevel gears to the tops of the governor spindle. I have no idea of the age, origin, speed or working pressure of this engine, but probably some reader could throw some light on the matter.

Yours faithfully,

Shaw, Lancs.

S. Lees.



*Elevations of the old steam engine in Lancashire*

Letter and sketch  
published in *Model  
Engineer*, 1947

Fig. 2: Mr Lees 1947 sketch of the Lancashire Table Engine

<b>Norden</b>	
A Lancashire Mill Engine	
<b>Mr Lees' 1947 letter</b>	
Scale: 1:12	1st Angle Projection
Date: 02/2009	◎ □
Sheet: 2	

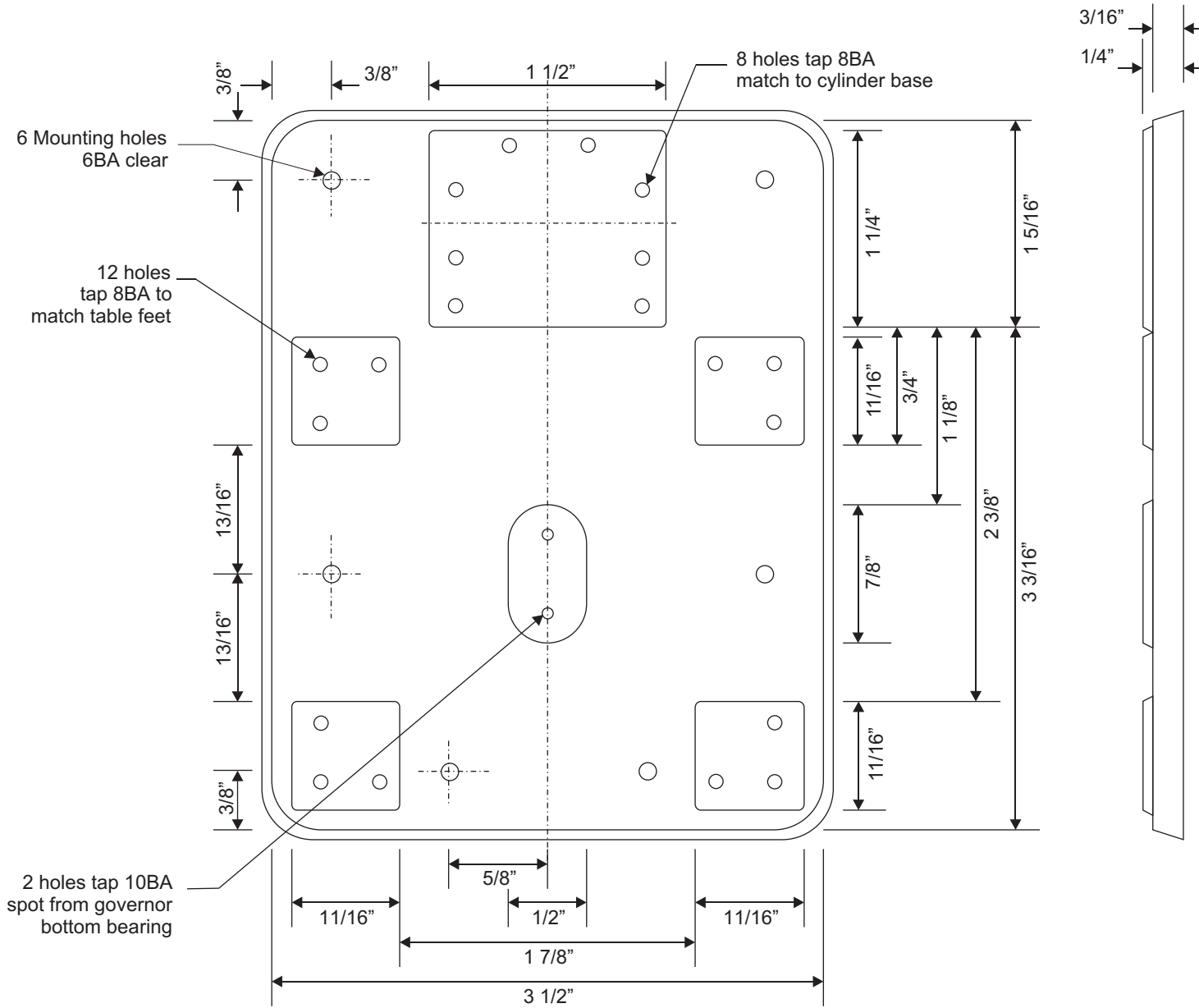


Fig. 3. Bedplate, CI

<b>Norden</b>	
A Lancashire Mill Engine	
<b>Bedplate</b>	
Scale: 1:12	1st Angle Projection
Date: 02/2009	
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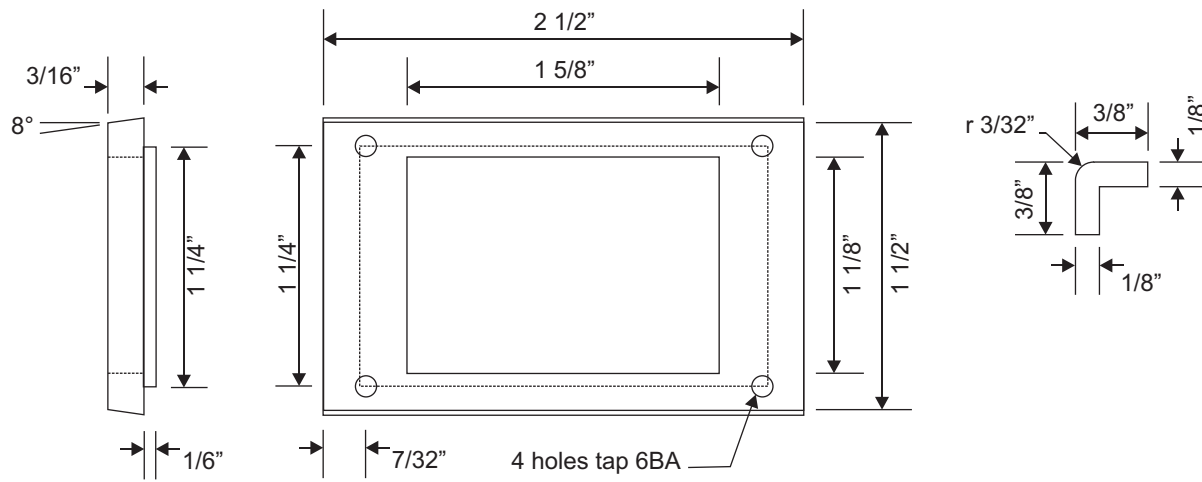


Fig. 4. Table Top, MS  
Make over-width and bevel edges after fabrication

Note: Optionally decorate edges of legs with 1/2 round 1/16" wide beading.

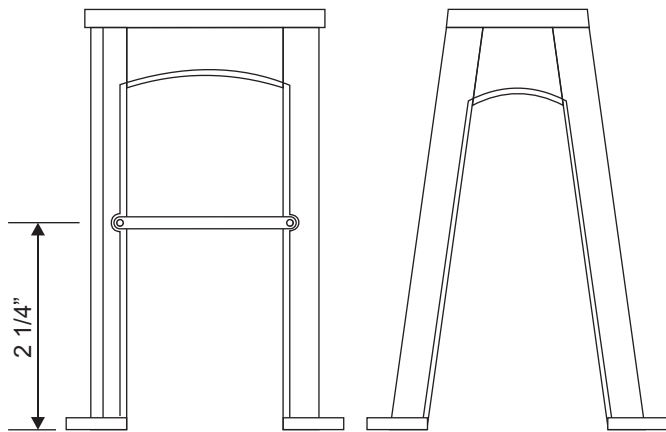


Fig. 10. Table - General Arrangement  
X0.5, MS fabrication

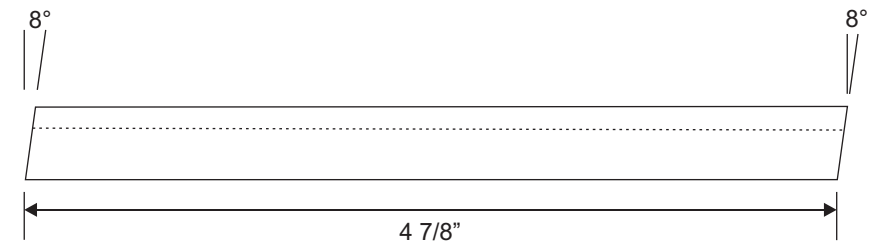


Fig. 5. Table Leg  
cut from larger size drawn or rolled MS, 4 off

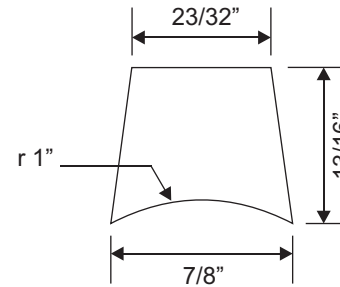


Fig. 6. Filler Piece  
1/8" thick MS, 2off  
Check shape from job

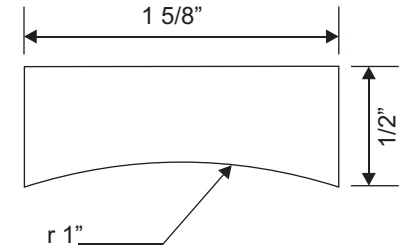


Fig. 7. Large Filler Piece  
1/8" thick MS, 2off

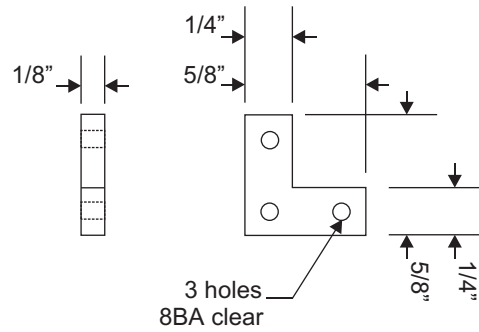


Fig. 8. Feet  
MS, 4 off

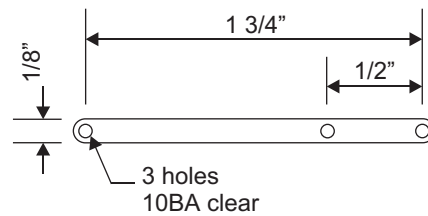


Fig. 9. Governor Support Bracket  
1/16" MS

<b>Norden</b>	
A Lancashire Mill Engine	
<b>Table</b>	
Scale: 1:12	1st Angle Projection
Date: 02/2009	
Sheet: 4	

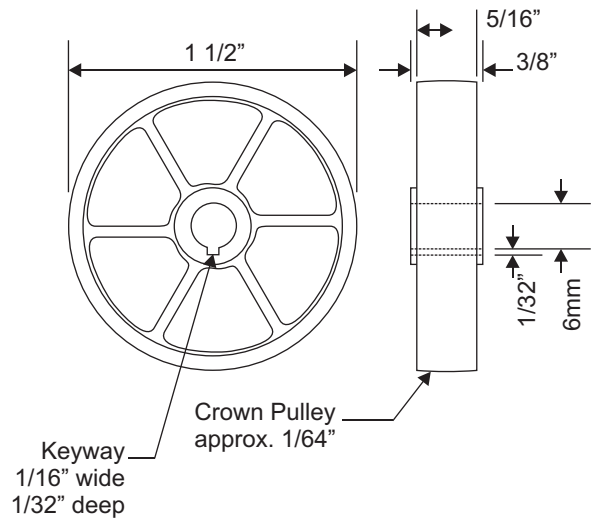


Fig. 13 Inner Pulley  
CI

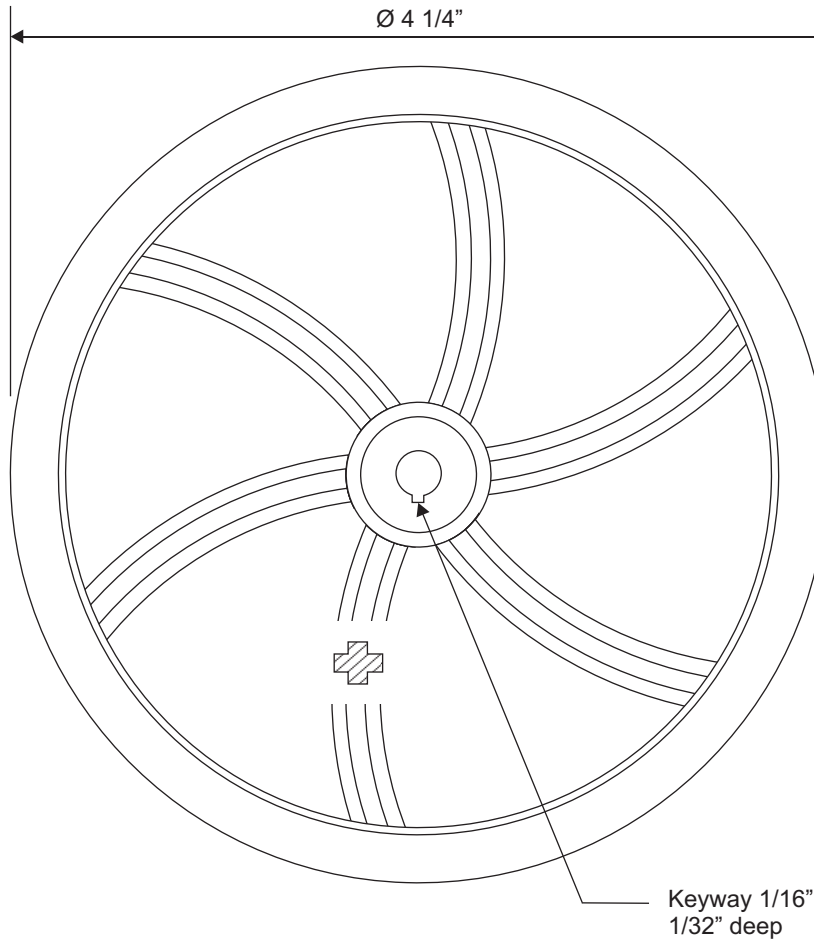


Fig. 11 Flywheel  
CI

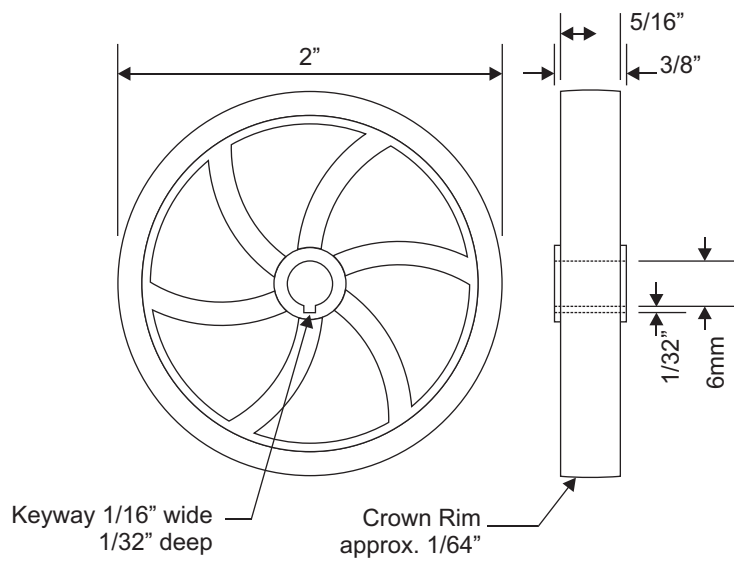
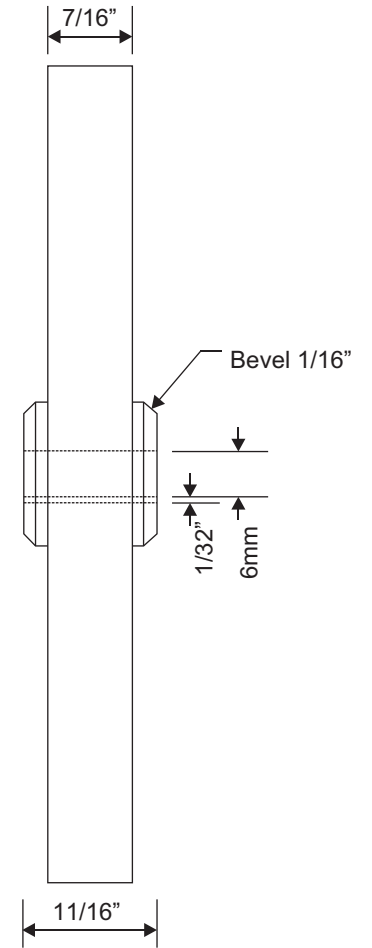


Fig. 12 Outer Pulley  
CI

**Norden**  
A Lancashire Mill Engine  
**Flywheel & Pulleys**

Scale: 1:12      1st Angle Projection  
Date: 02/2009  
Sheet: 5

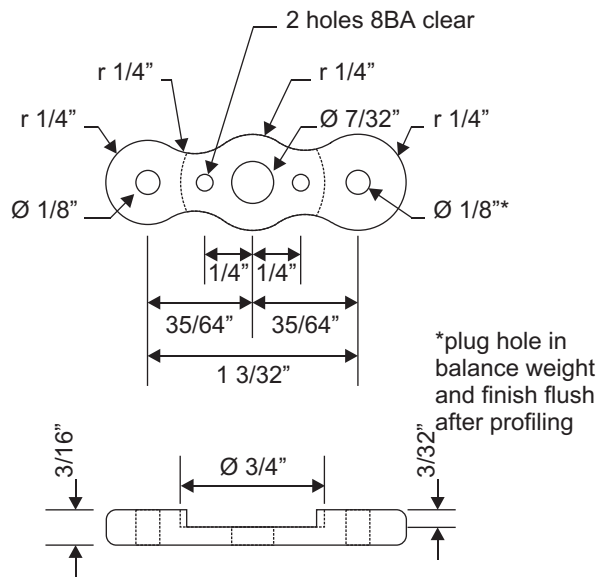


Fig. 15 Crankweb, MS

\*plug hole in balance weight and finish flush after profiling

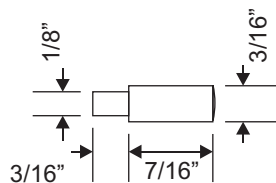


Fig. 16 Crankpin MS or Silver Steel

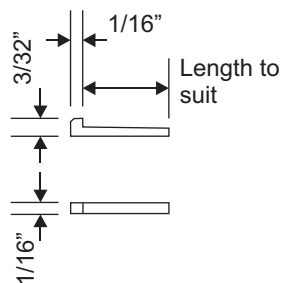
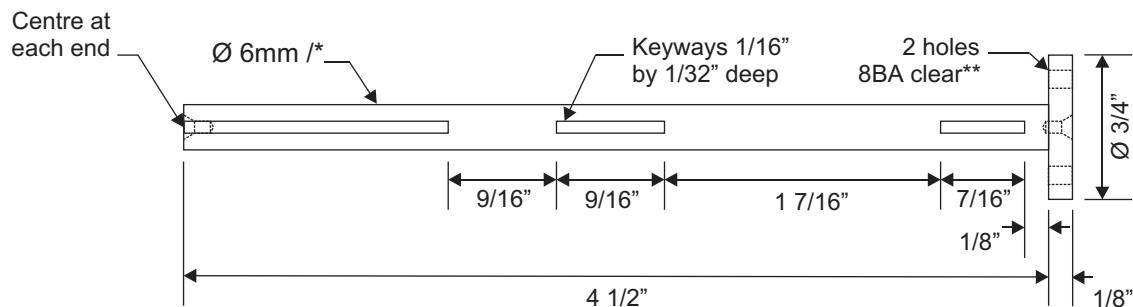


Fig. 17 Key, MS 5 off



\*Imperial alternative  $\text{\O} 7/32$ ”; amend bores of all mating components if used.  
 \*\*Spot through from crankweb once valve events have been set correctly.

Check positions of keyways by trial assembly.

Fig. 14 Crankshaft MS

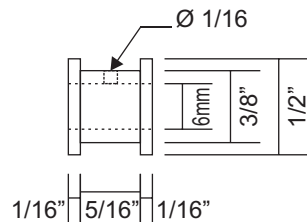


Fig. 20 Main Bearings Bronze 2off

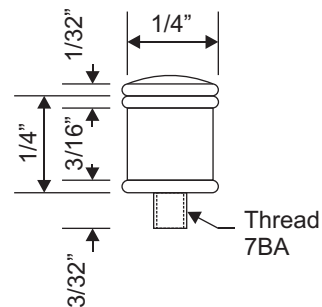


Fig. 21 Lubricator X2, Brass, 2 off

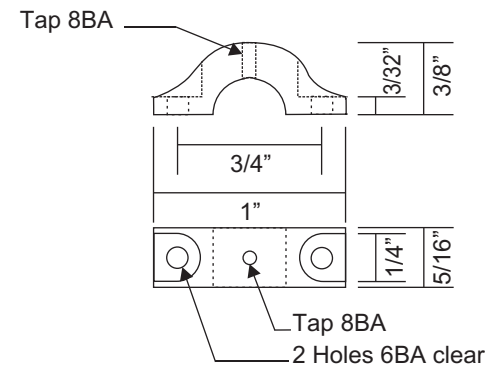


Fig. 18 Bearing Cap MS 2 off

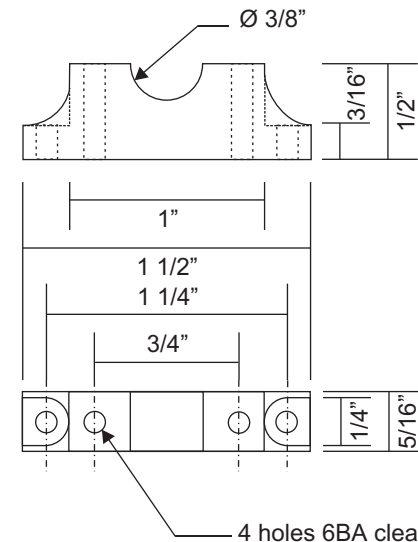


Fig. 19 Bearing Block MS 2 off

**Norden**

A Lancashire Mill Engine  
**Crankshaft & Bearings**

Scale: 1:12      1st Angle Projection  
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 Sheet: 6

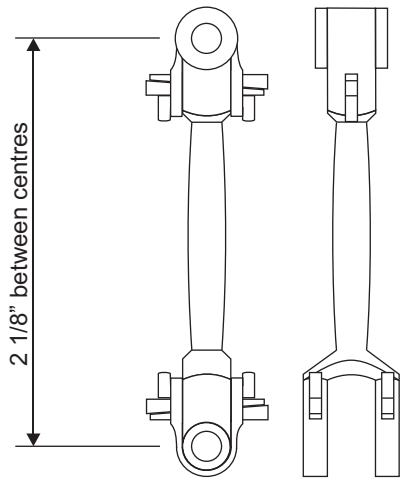


Fig. 22 Connecting Rod  
General Arrangement

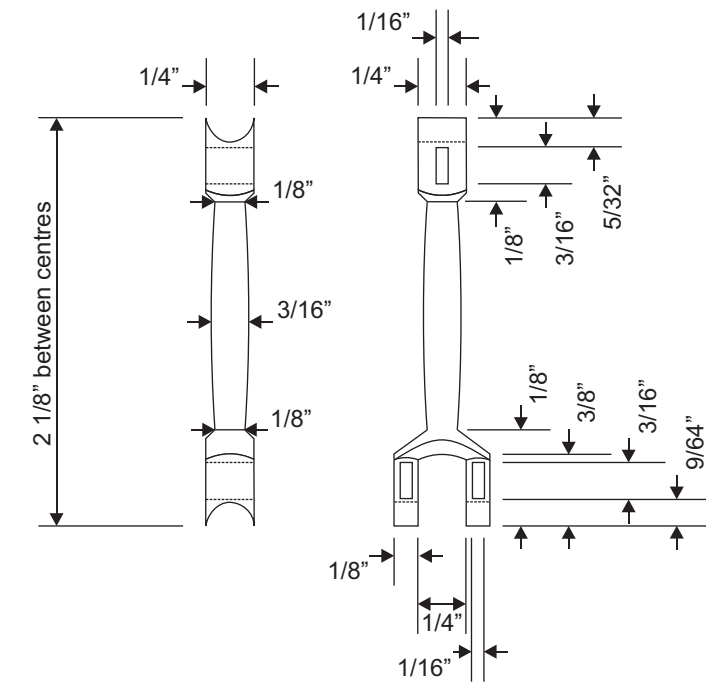


Fig. 23 Connecting Rod  
MS

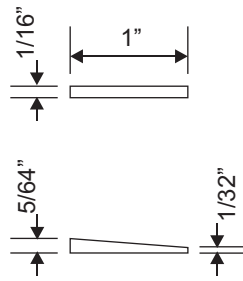


Fig. 26 Wedges  
MS, 6 off

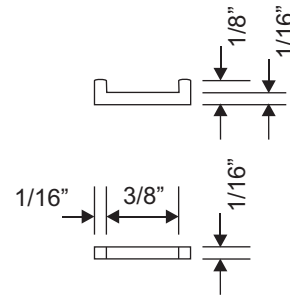


Fig. 27 Cotter  
MS, 4 off

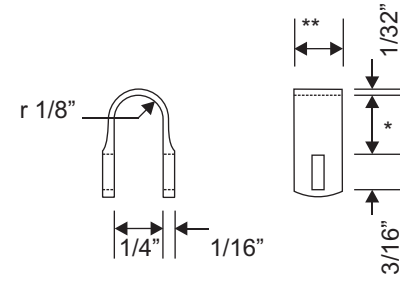


Fig. 28 Bearing Strap  
MS, 3 off  
Profile before  
bending. Slot last.

\*Adjust distance  
to ensure  
bearings are  
gripped by strap  
connecting rod.

\*\*make one at  
1/4" wide, two  
at 1/8" wide

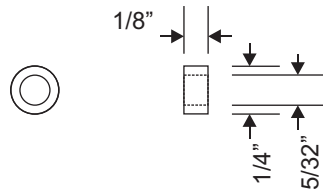


Fig. 24 Little End Bush  
Bronze, 2 off

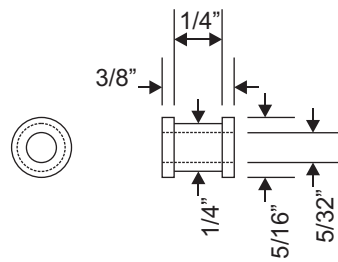


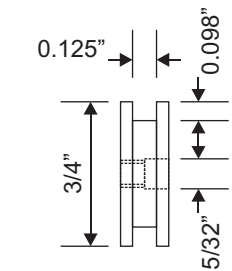


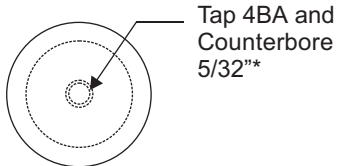
Fig. 25 Big End Bush  
Bronze

<b>Norden</b>	
A Lancashire Mill Engine	
<b>Connecting Rod</b>	
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Groove dimensions to suit o-ring  
3/4" OD, 1/8" width



Tap 4BA and Counterbore 5/32"\*  
\*Use high temperature retainer or counterbore underside for 4BA locknut

Fig. 33 Piston  
Brass or GM

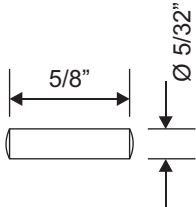


Fig. 31 Crosshead Pin  
silver steel

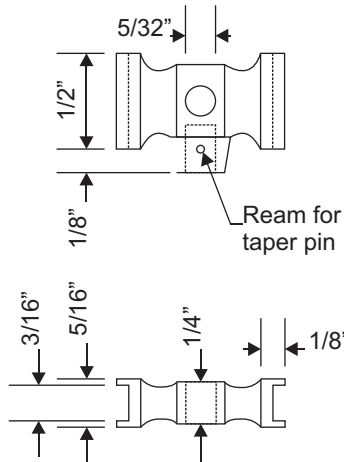


Fig. 30 Crosshead  
CI or GM

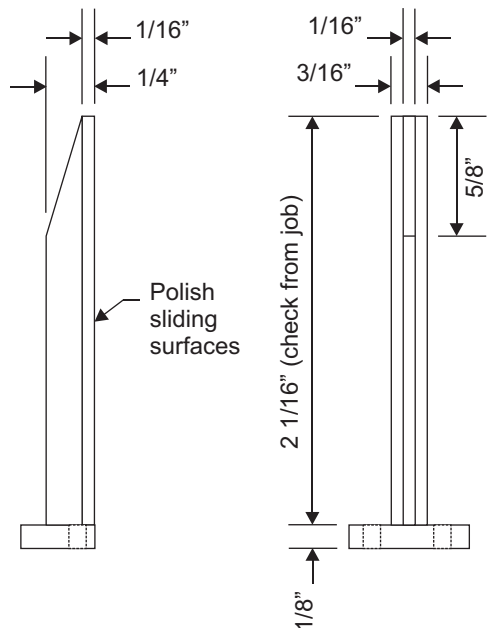


Fig. 29 Crosshead Guide Bars  
MS fabrication, 2off

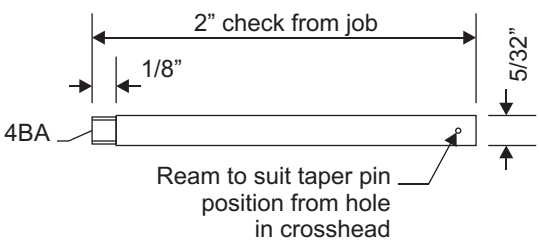


Fig. 32 Piston Rod  
Stainless Steel

Note: Use 1/8" bore o-ring as gland packing

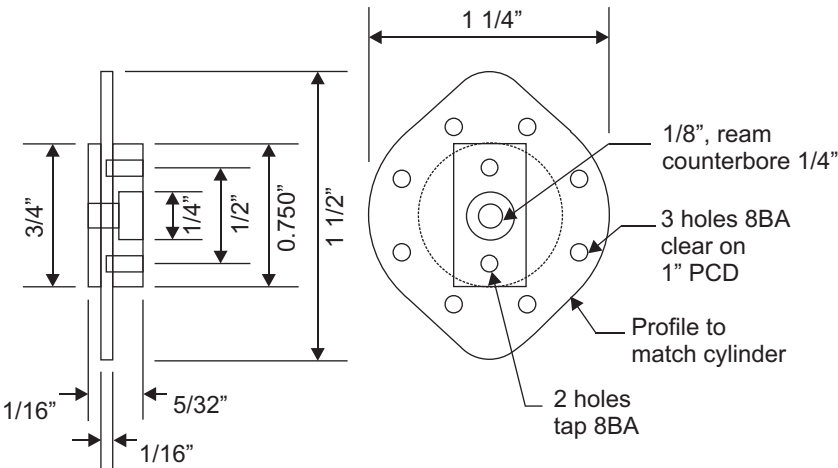
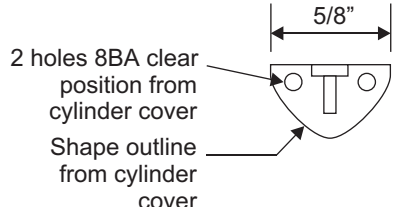


Fig. 34 Cylinder Top Cover  
CI

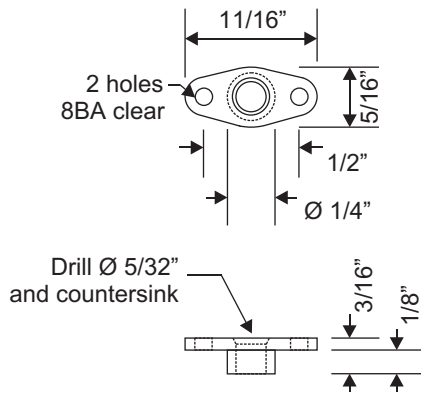


Fig. 35 Piston Rod Gland  
Brass

**Norden**  
A Lancashire Mill Engine  
**Piston and Cylinder Cover**  
Scale: 1:12 1st Angle Projection  
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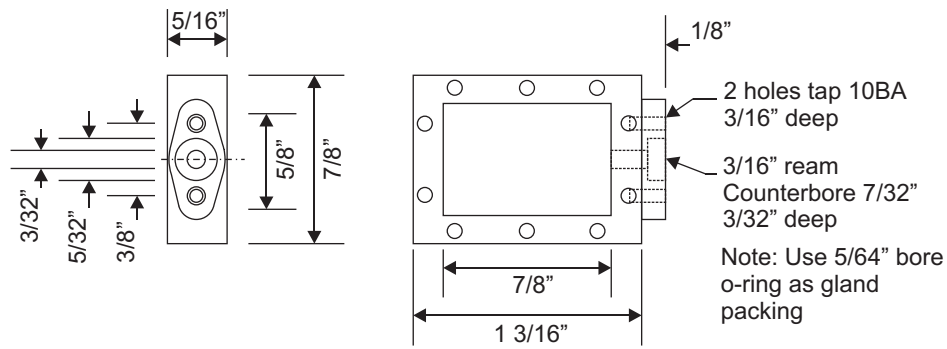


Fig. 37 Steam Chest, Cast Iron

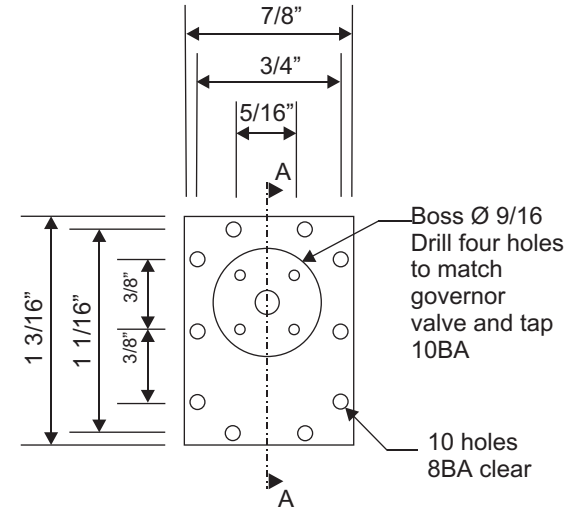
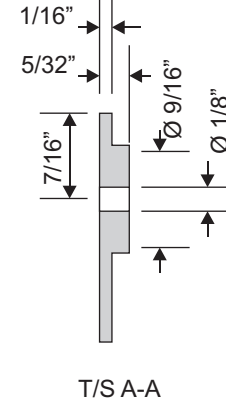


Fig. 39 Steam Chest Cover  
C.I.

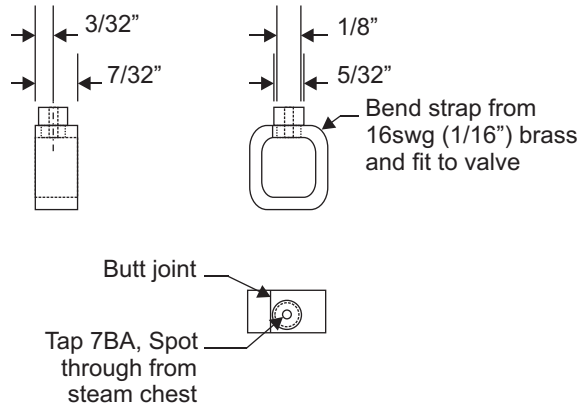


Fig. 45 Valve Strap  
Brass Fabrication

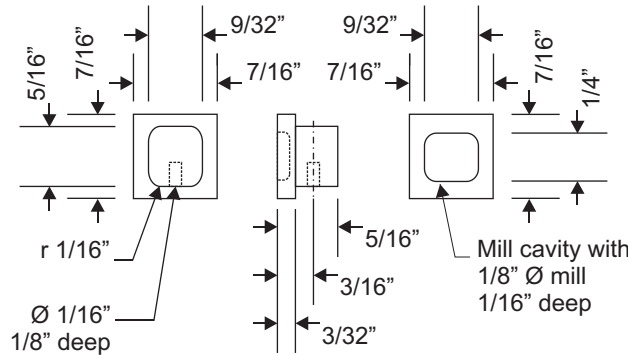


Fig. 44 Valve, Brass or Bronze

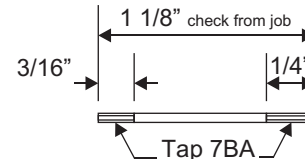


Fig. 43 Valve Rod  
3/32" Stainless Steel

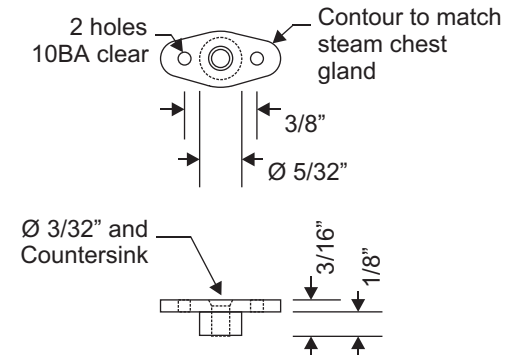


Fig. 38 Valve Rod Gland  
Brass

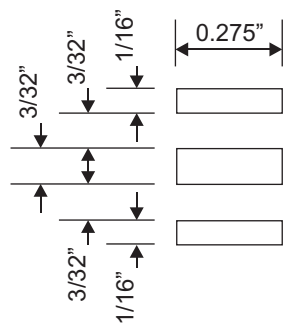


Fig. 40 Valve Port dimensions  
2x actual size

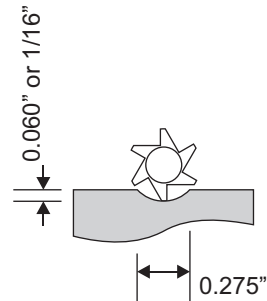


Fig. 42 Cutter Infeed  
for Valve Ports

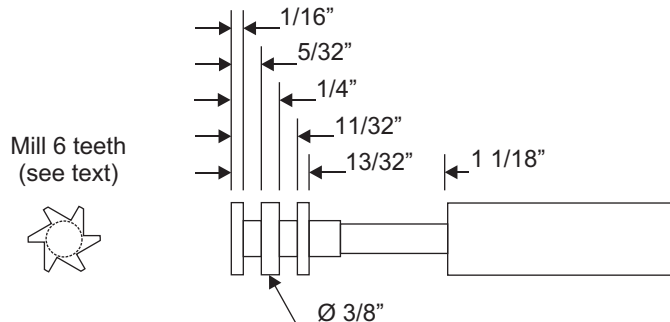


Fig. 41 Ganged Cutter for Steam Ports  
Silver Steel, harden and temper to straw

**Norden**

A Lancashire Mill Engine  
**Steam Chest & Valve**

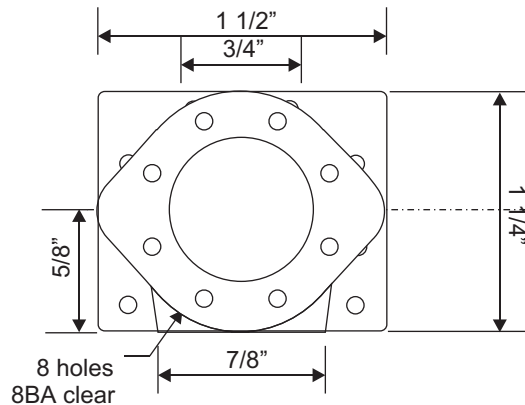
Scale: 1:12      1st Angle Projection

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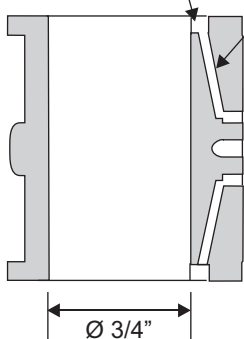
Spot through upper holes from Cylinder Top Cover and tap 8BA

Spot through lower holes from base plate.



2 semicircular pockets  
Ø 3/16", 3/32" deep

Steam passages  
Ø 1/16"



Cylinder  
Cross section of port face

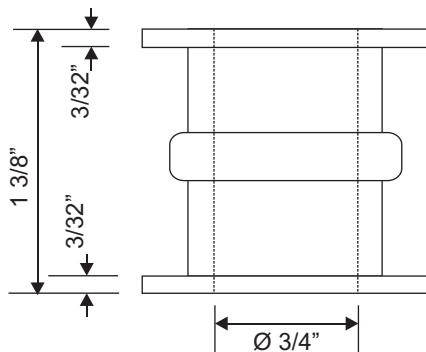
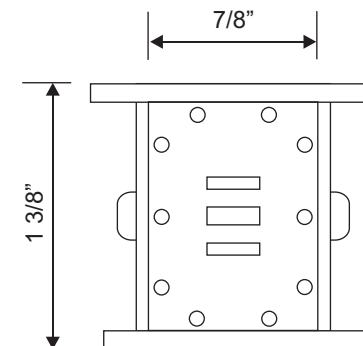
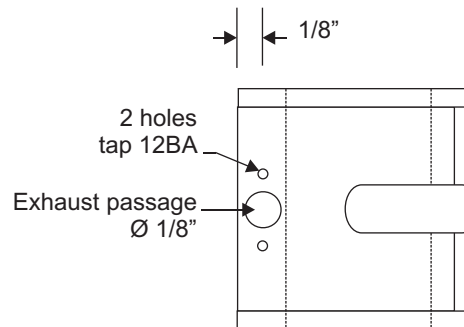


Fig. 36 Cylinder  
CI



Spot through 10 holes from Steam Chest Cover and tap 8BA

Mill valve ports with cutter as described on sheet 'steam chest'.

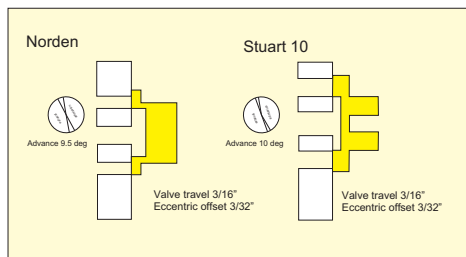


Fig. 36a Comparison of valve events with Stuart No. 10V  
Note late cut-off and minimal expansive working in both cases

## Norden

A Lancashire Mill Engine

### Cylinder

Scale: 1:12    1st Angle Projection

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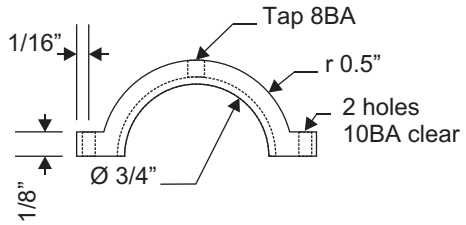
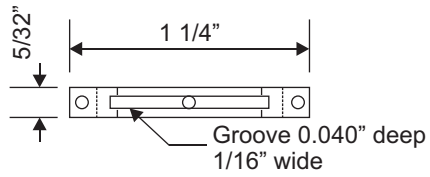


Fig. 47a Eccentric Strap, Top  
CI or Brass

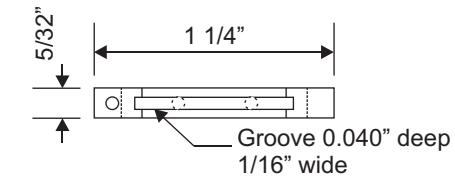
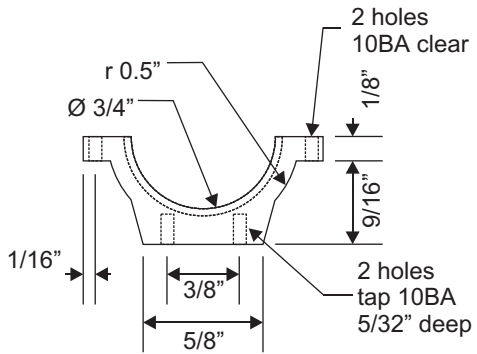


Fig. 47b Eccentric strap, Bottom  
CI or Brass

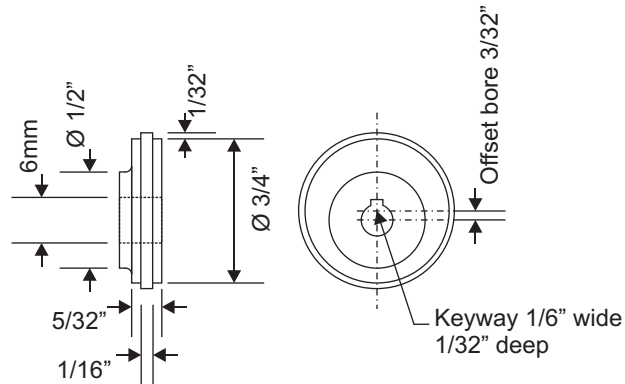


Fig. 46 Eccentric Valve travel 3/16 inch  
CI or Brass Eccentric offset 3/32 inch

Note: 7BA threads for valve rod can be replaced with 8BA, M2.5 or 3/32 inch x 40 tpi to suit equipment available

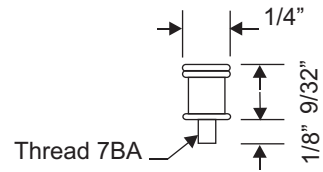


Fig. 48 Eccentric Lubricator  
Brass

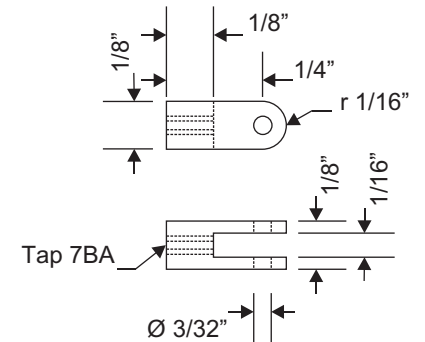


Fig. 50 Valve Rod Knuckle  
x2 Brass

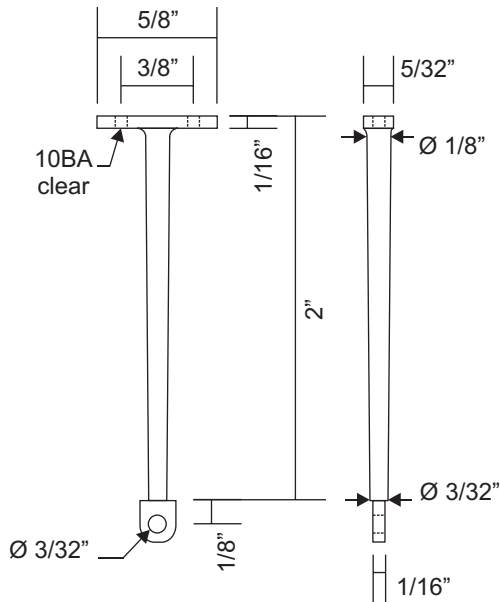


Fig. 49 Valve Connecting Rod  
MS Fabrication

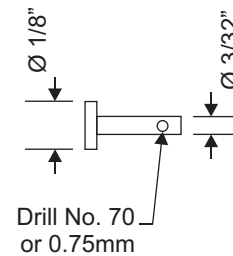


Fig. 51 Valve Rod Knuckle Pin  
x2, MS

<b>Norden</b>	
A Lancashire Mill Engine	
<b>Valve Gear</b>	
Scale: 1:12	1st Angle Projection
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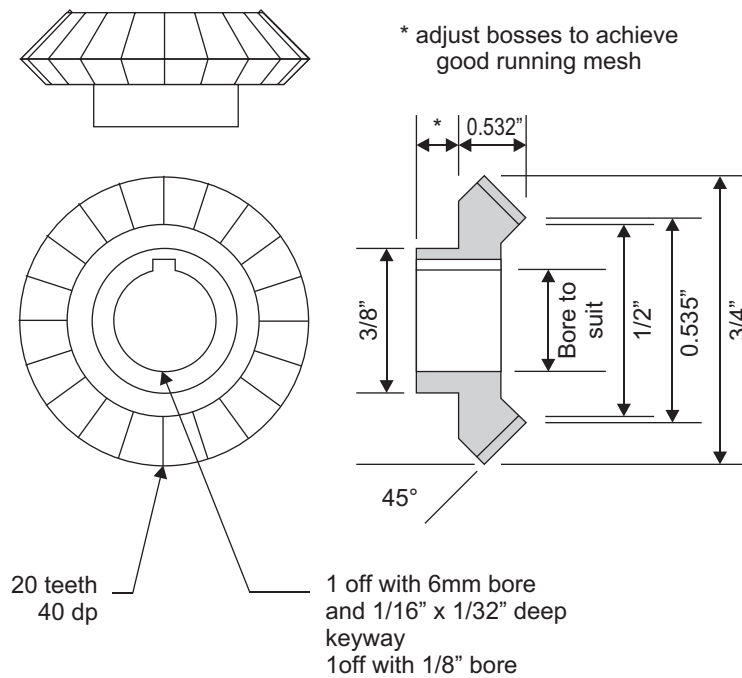


Fig. 52 Governor Bevel Gear  
X2, Brass, MS or CI, 2 off

Note: Any pair of matching 45° bevel gears with an overall diameter of about 3/4" and bosses that can be bored or bushed to a suitable size may be used.

## Bevel Gear Specification

Information required to use Ivan Law's parallel depth bevel method (*Gears and Gear Cutting*, Chapter 11, Workshop Practice Series, No 17).

20 teeth, 40DP, 20° pressure angle  
 Blank Diameter: 0.75"  
 Cutter number: 4 (26-34 teeth)  
 Depth of cut: 0.054"  
 Blank roll: 1/80 revolution = 4.5°  
 Cutter offsets: +/- 0.020"

For home made cutter (*ibid.* chapter12) use the dimensions below to make and use the form tool.

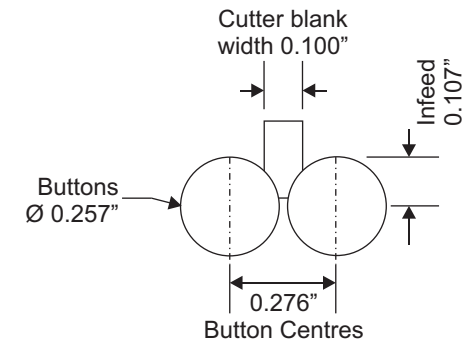


Fig. 53 Form tool for gear cutters  
X2

<b>Norden</b>	
A Lancashire Mill Engine	
<b>Bevel Gears</b>	
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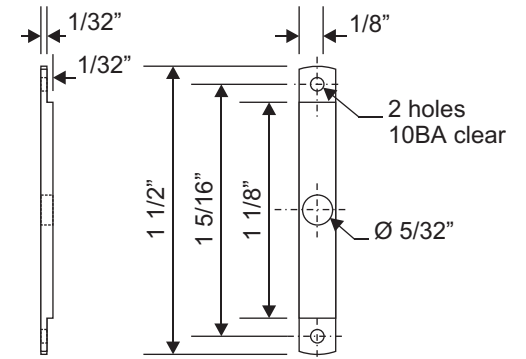
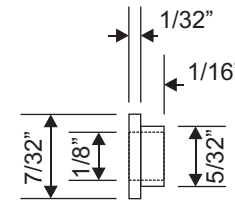
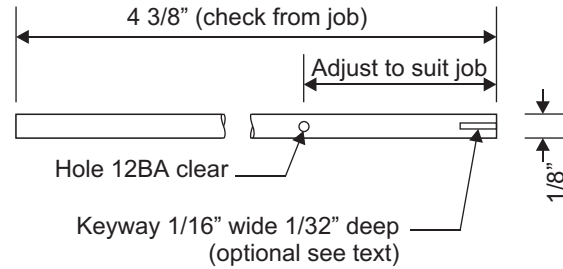
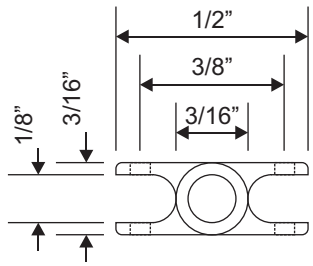


Fig. 58 Governor Spindle  
MS or Silver Steel

Fig. 57 Upper Spindle Bearing  
X2, Brass

Fig. 56 Governor Support Bar  
MS

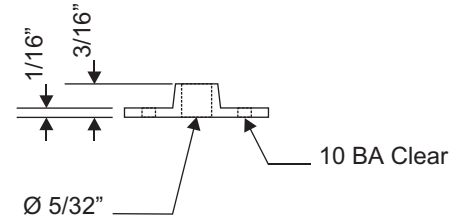
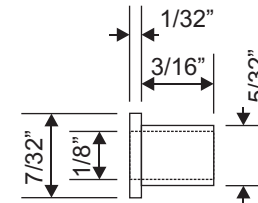
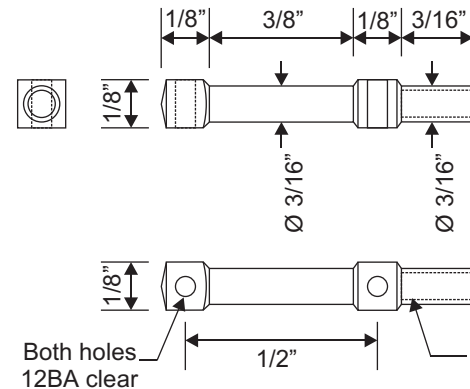
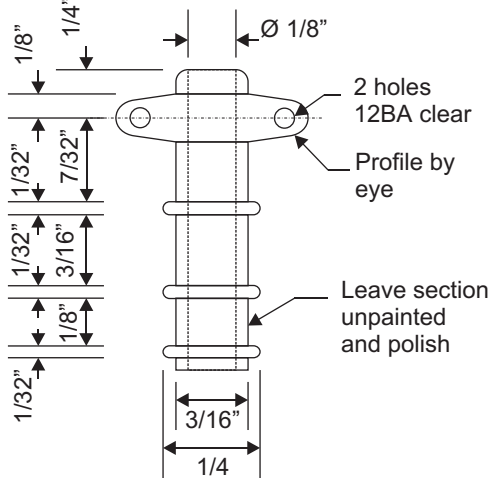


Fig. 61 Lower (moving) Sleeve  
x2, Brass

Fig. 55 Lower Spindle Bearing Bush  
2x, Brass

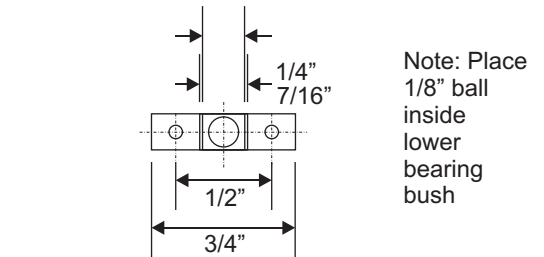


Fig. 59 Upper Swing Arm  
X2, Mild Steel, 2 off

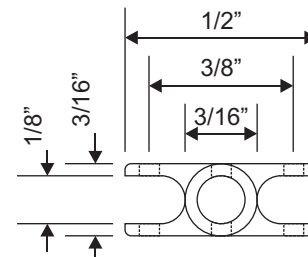
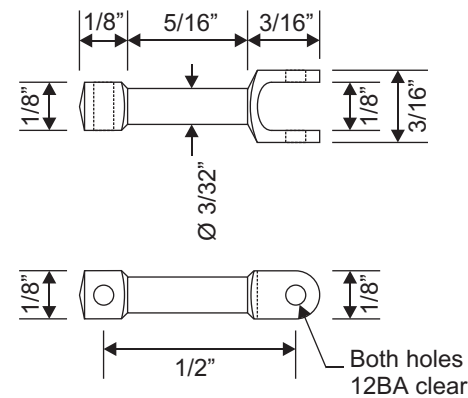


Fig. 54 Bottom Bearing Housing  
MS or CI

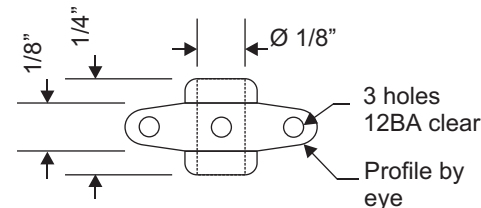
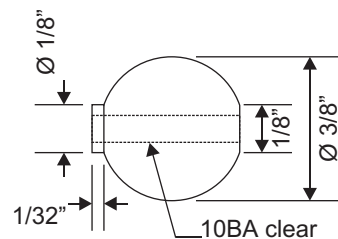


Fig. 60 Lower Swing Arm  
X2, Mild Steel, 2 off

Fig. 63 Governor Weights  
2x, Brass, 2 off

Fig. 62 Upper (fixed) Sleeve  
x2, Brass

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**Governor 1 - rotating parts**  
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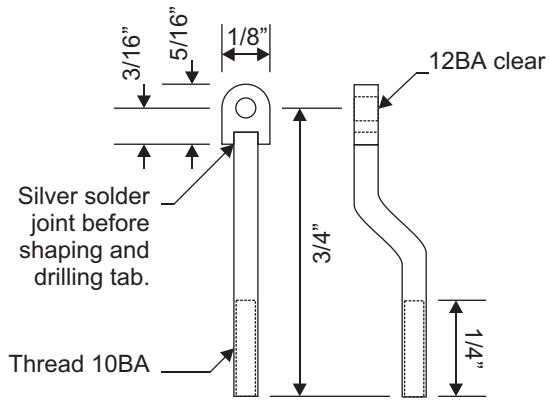


Fig. 68 Upper Lifting Link  
X2, Brass fabrication

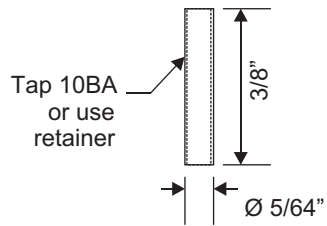


Fig. 69 Lifting Link Adjuster  
X2, Brass

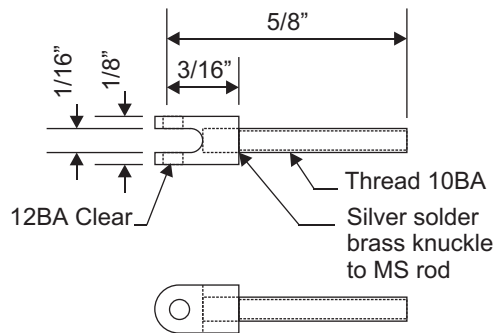


Fig. 70 Lower Lifting Link  
X2, Brass & MS fabrication

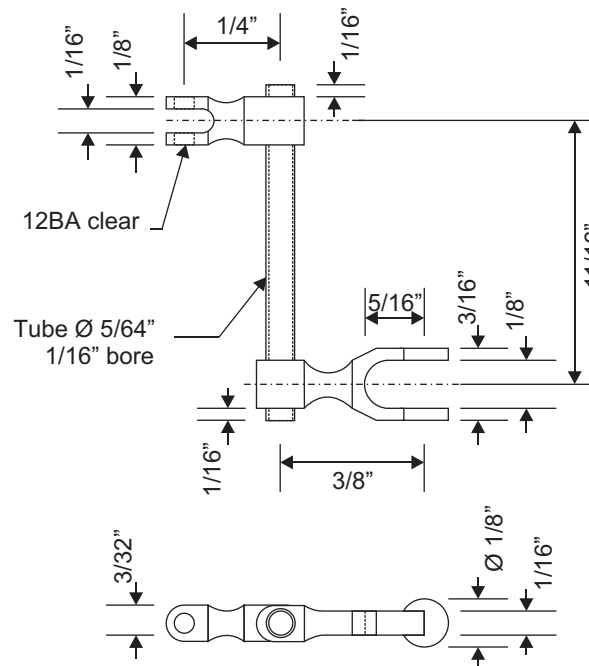


Fig. 66 Governor Fork Assembly  
X2, Brass fabrication

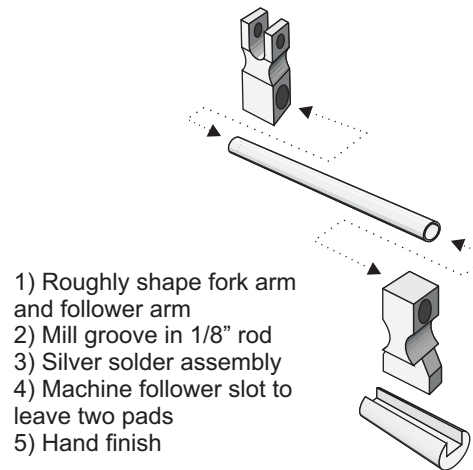


Fig. 67 Governor Fork Tube  
Assembly Guide

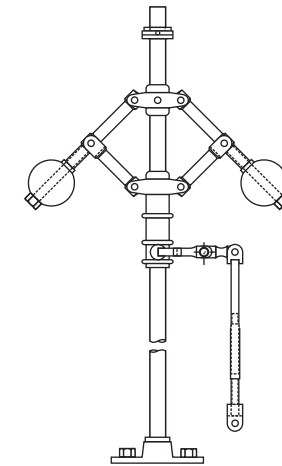


Fig. 64 Governor  
General Arrangement  
not to scale

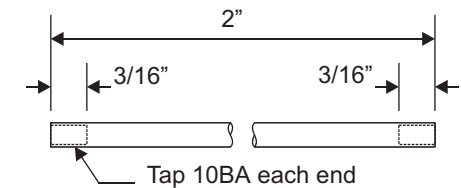


Fig. 65 Governor Lever Shaft  
X2, 1/16" Ø MS

**Norden**

A Lancashire Mill Engine  
**Governor 2 - linkages**

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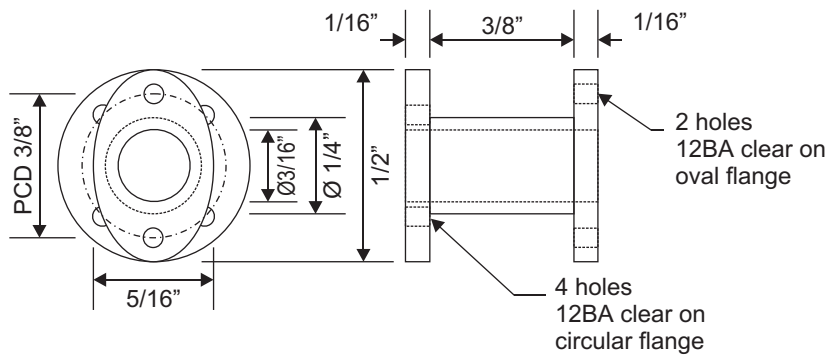


Fig. 76 Exhaust Stub  
X2, Brass

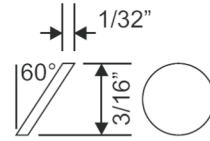


Fig. 74 Valve Butterfly  
X2, Slice of 3/16" Brass Bar

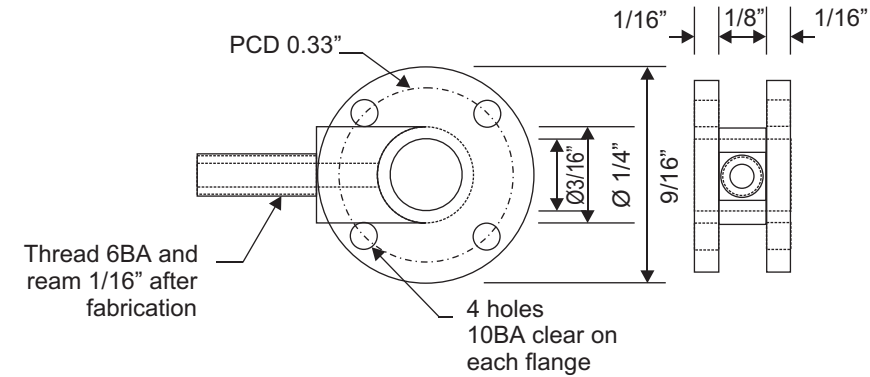


Fig. 71 Governor Valve Housing  
X2, Brass Fabrication

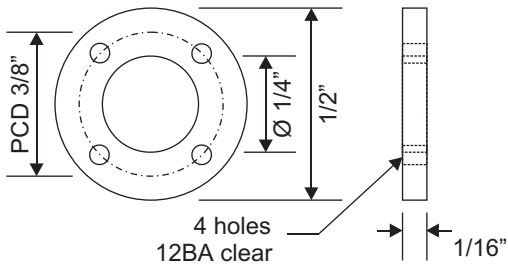


Fig. 77 Pipe Flanges  
X2, Brass, 4 off

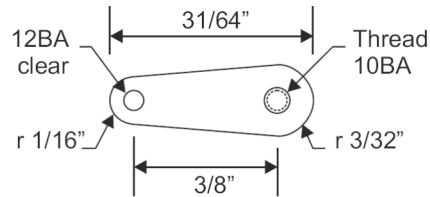


Fig. 75  
Governor Valve Lever  
X2, MS 1/16" thick

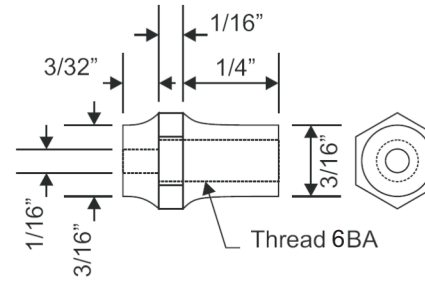


Fig. 73 Governor Valve Gland  
Brass, 1 off

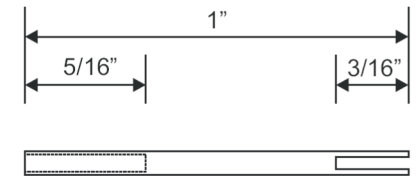


Fig. 72 Governor Valve Spindle  
X2, Stainless Steel, Ø 1/16"

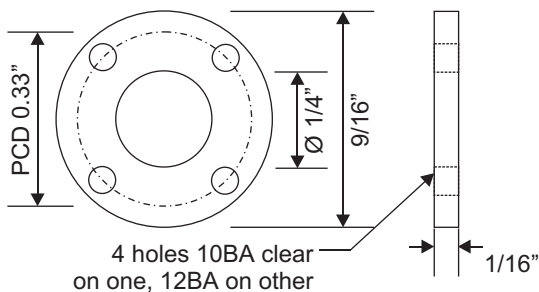


Fig. 78 Pipe Flange  
X2, Brass, 2 off

### Pipework

The steam and exhaust pipes should be made from 1/4"Ø copper pipe. The steam pipe needs to make a 90° bend to avoid the governor spindle.

The pipe flanges are best drilled after assembly to the pipes. Make drilling jigs by counterboring a socket for the flange in 1 slice of 3/4" steel bar, and drilling suitably positioned guide holes.

**NOTE:** The flanges for the governor valve and engine side of the steam stop valve are larger than the others.

## Norden

A Lancashire Mill Engine  
Pipes & Governor Valve

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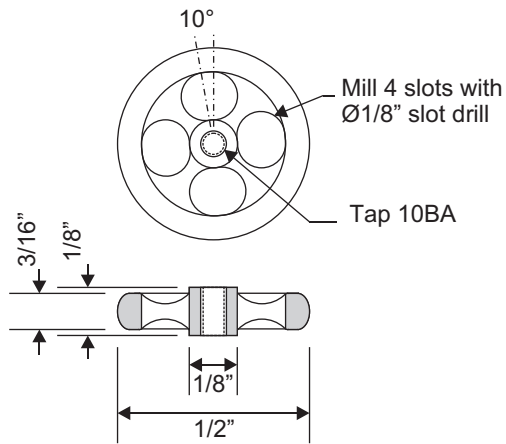


Fig. 84 Stop Valve Handwheel  
X2, Brass

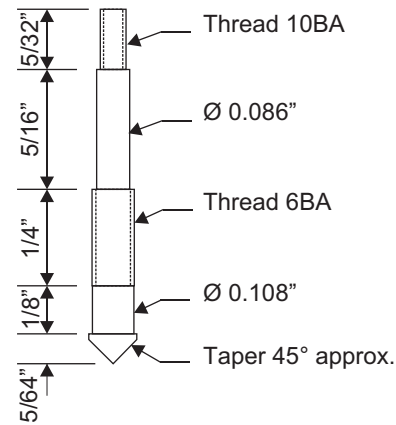


Fig. 81 Valve Spindle  
X2, Stainless Steel

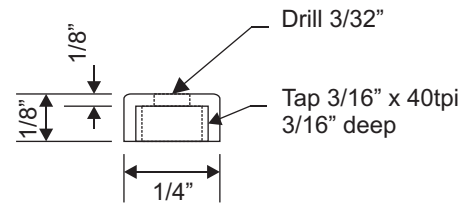


Fig. 83 Gland Nut  
X2, 1/4 inch Brass Hexagon

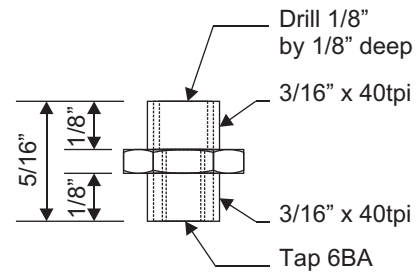


Fig. 82 Stop Valve Gland  
X2 5/16 inch AF Brass Hexagon

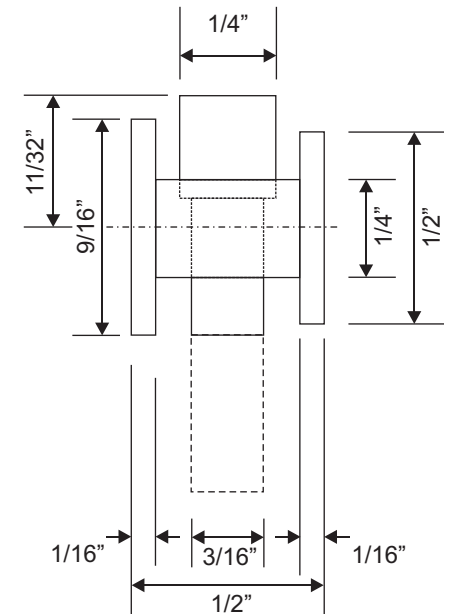


Fig. 79 Stop Valve Body  
Method of fabrication  
Make central portion  
overlength to provide  
chucking piece.

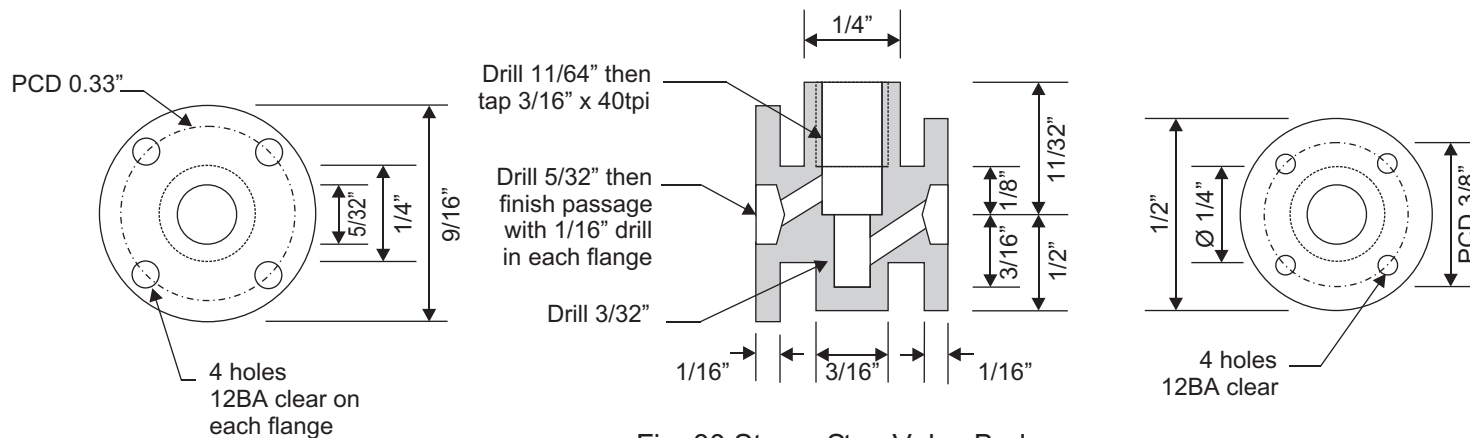


Fig. 80 Steam Stop Valve Body  
X2, Brass fabrication

Note: The steam stop valve is essentially as Tubal Cain's design for *Lady Stephanie*, but slightly simplified and modified.

**Norden**

A Lancashire Mill Engine  
**Steam Stop Valve**

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