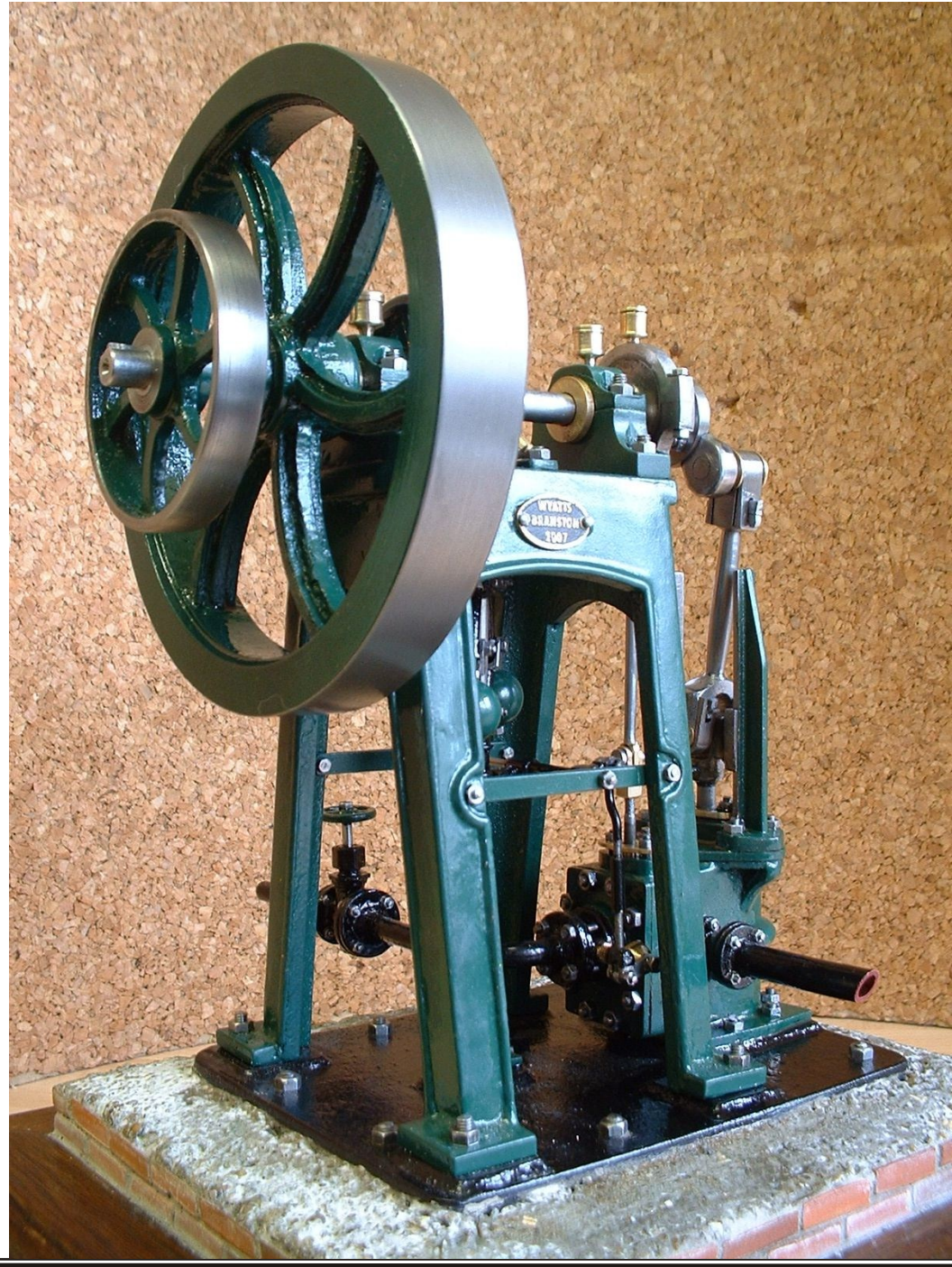
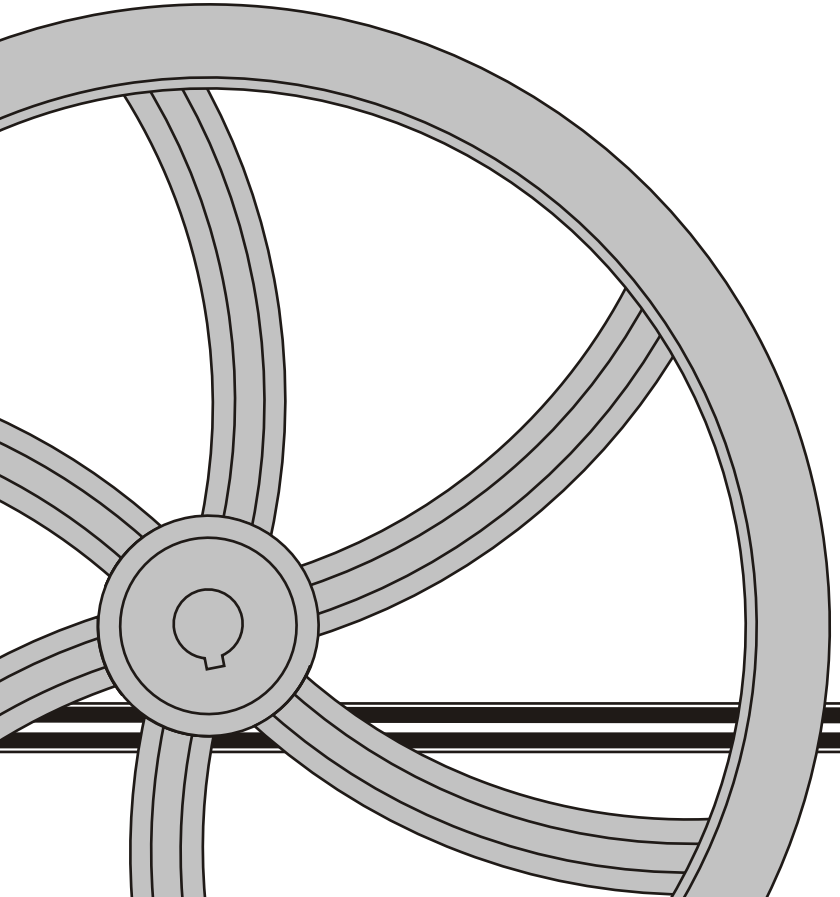
Norden

A Lancashire Mill Engine

Scale: 1:12





Neil M. Wyatt
February 2009

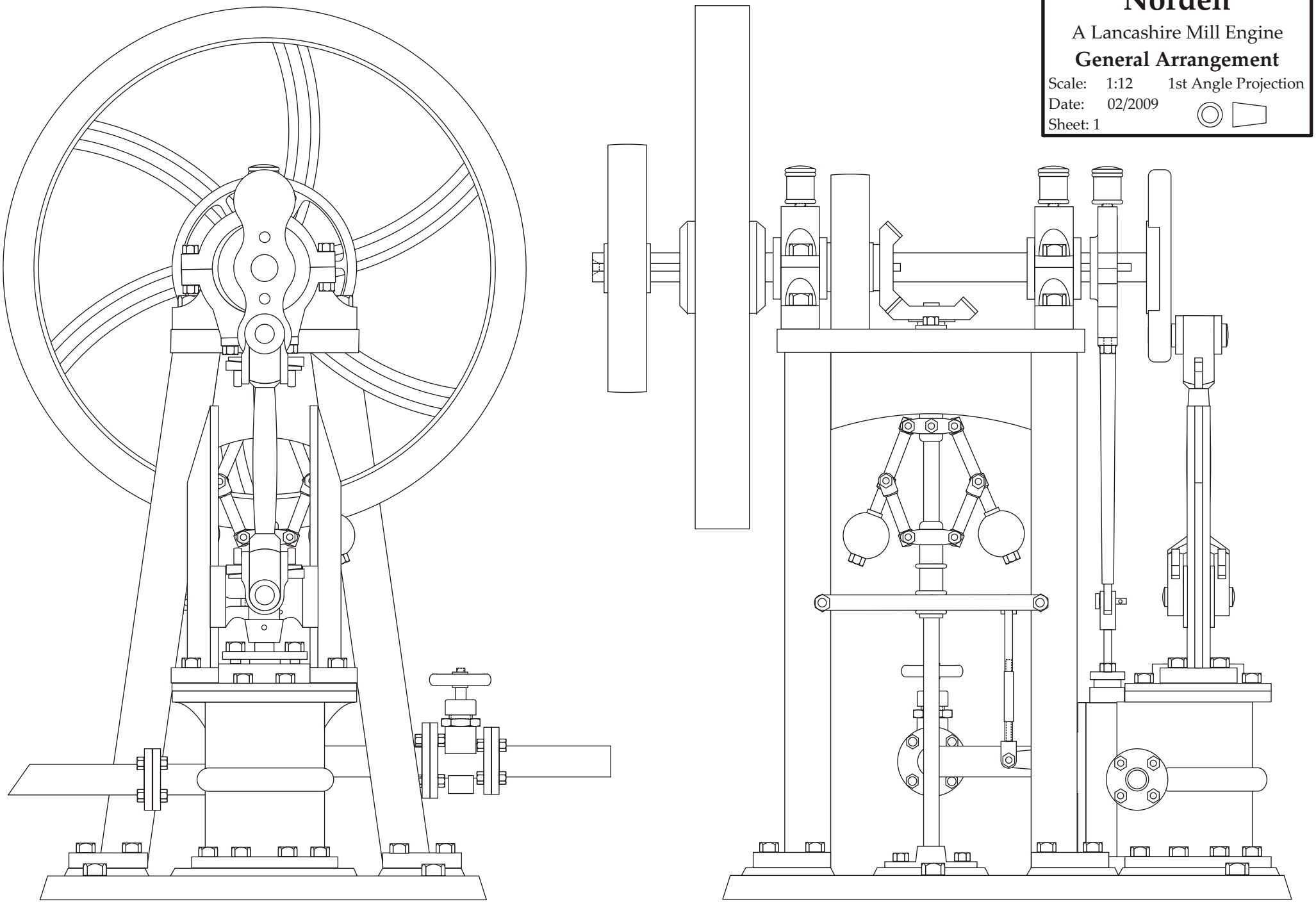


Fig. 1: General Arrangement

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.

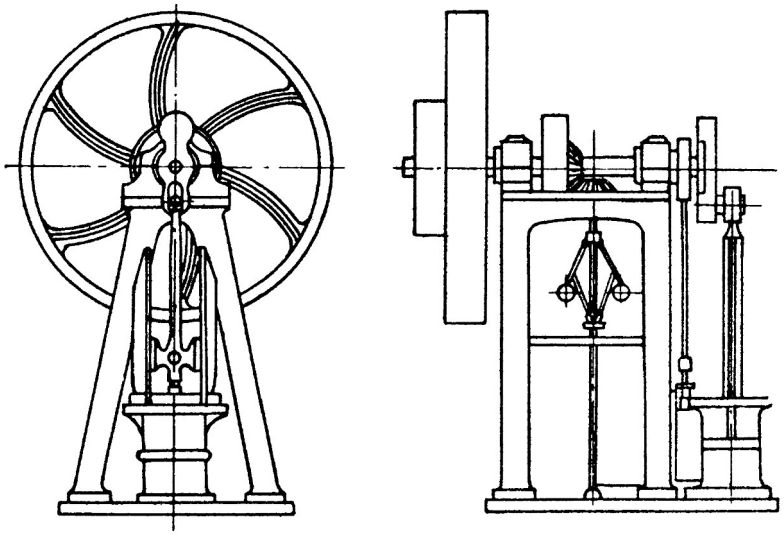
The connecting rod is bellied and has strap and cotter big- and little-ends. The centres of the connecting rod are 2 ft. 1 in.

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.



Elevtions of the old steam engine in Lancashire

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

Letter and sketch published in Model Engineer, 1947

Norden

A Lancashire Mill Engine

Mr Lees' 1947 letter

Scale: 1:12 1st Angle Projection

Date: 02/2009

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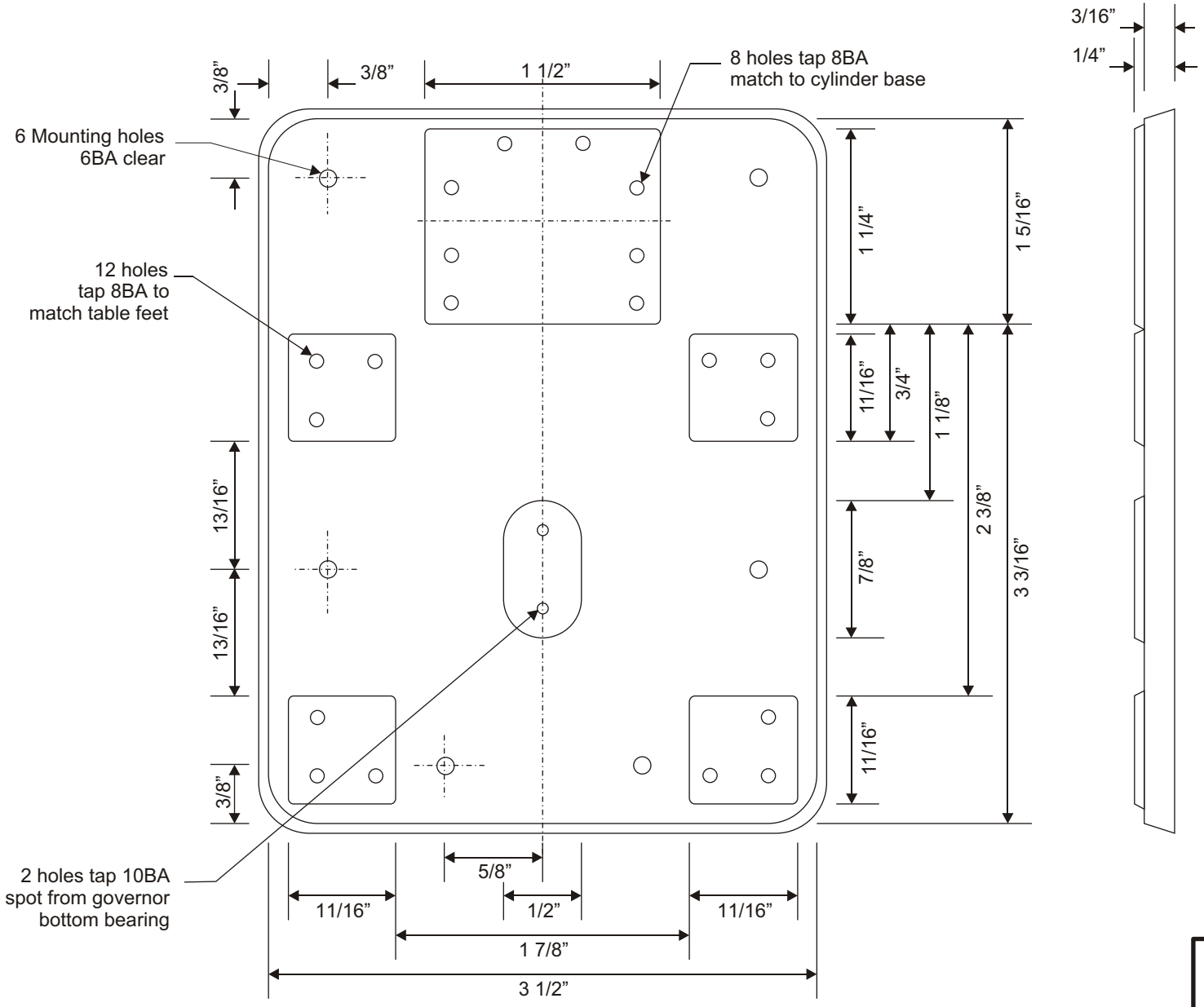

Fig. 3. Bedplate, CI

Norden

A Lancashire Mill Engine

Bedplate

Scale: 1:12 1st Angle Projection

Date: 02/2009

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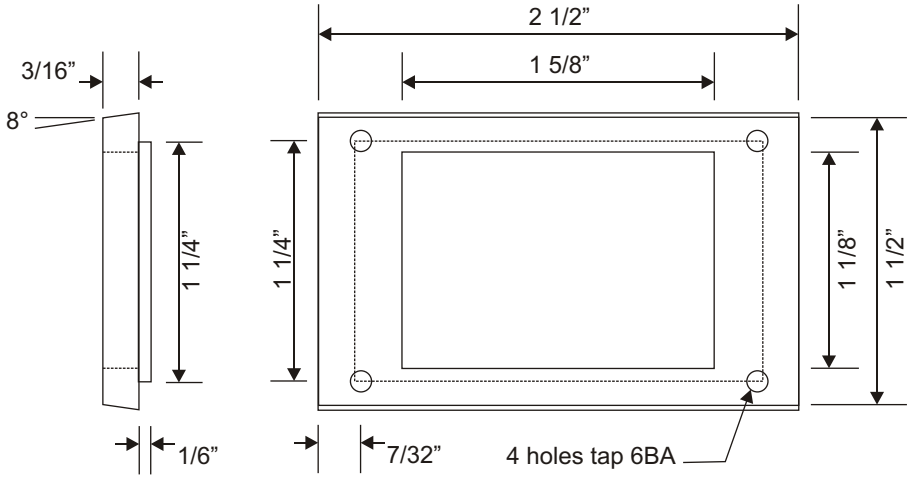

Fig. 4. Table Top, MS
Make over-width and bevel edges after fabrication

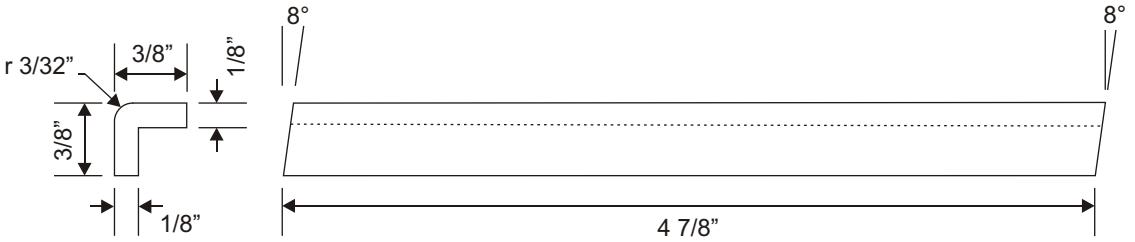

Fig. 5. Table Leg
cut from larger size drawn or rolled MS, 4 off

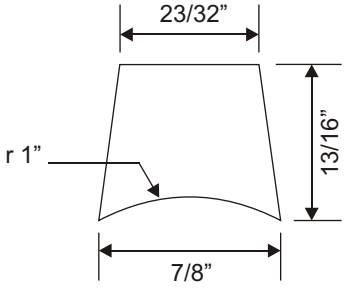

Fig. 6. Filler Piece
1/8” thick MS, 2off
Check shape from job

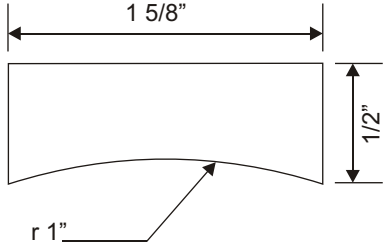

Fig. 7. Large Filler Piece
1/8” thick MS, 2off

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

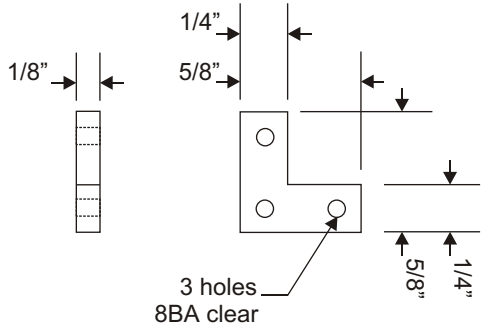

Fig. 8. Feet
MS, 4 off

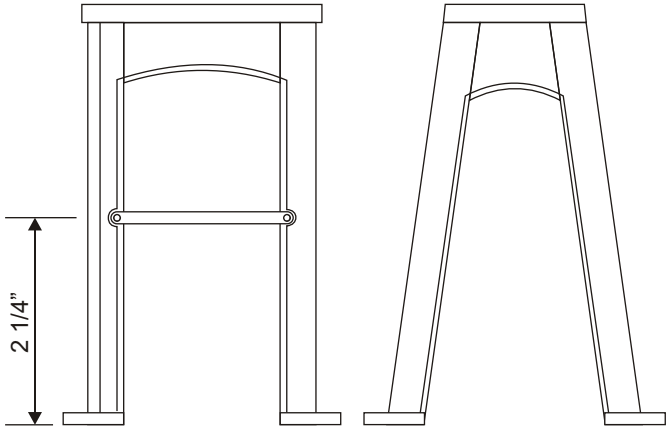

Fig. 10. Table - General Arrangement
X0.5, MS fabrication

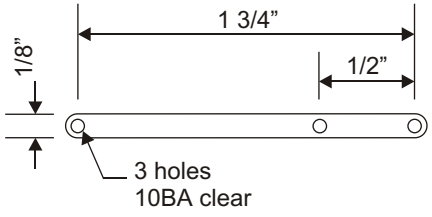

Fig. 9. Governor Support Bracket
1/16” MS

Norden

A Lancashire Mill Engine

Table

Scale: 1:12 1st Angle Projection
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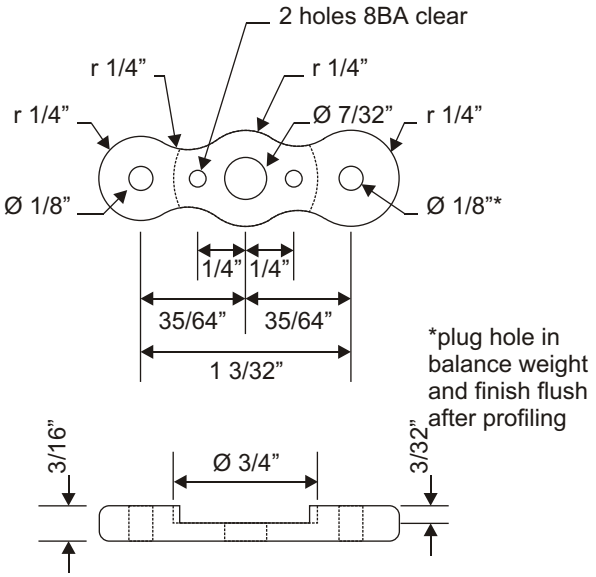

Fig. 15 Crankweb, MS

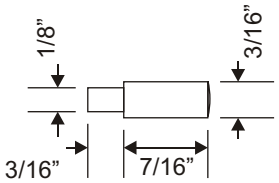

Fig. 16 Crankpin
MS or Silver Steel

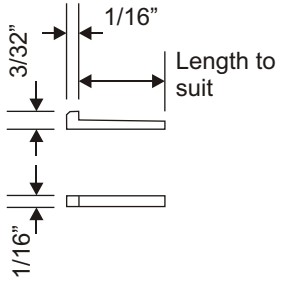

Fig. 17 Key, MS
5 off

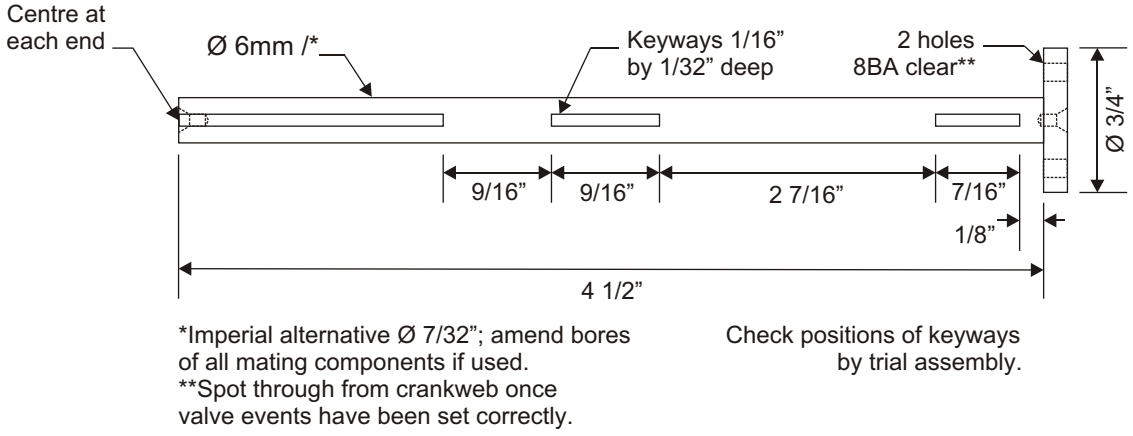

Fig. 14 Crankshaft
MS

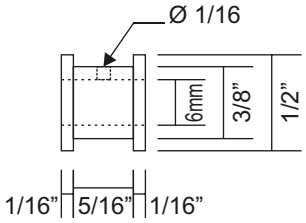

Fig. 20 Main Bearings
Bronze 2off

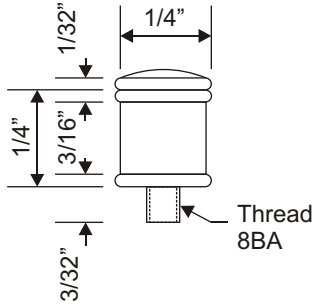

Fig. 21 Lubricator (dummy)
X2, Brass, 3 off

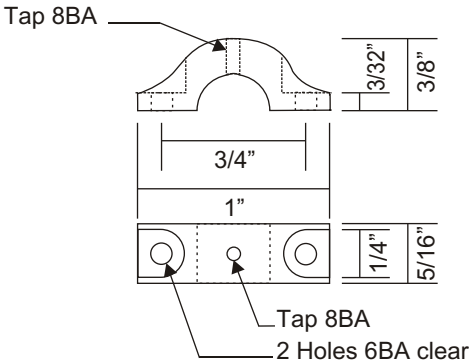

Fig. 18 Bearing Cap
MS 2 off

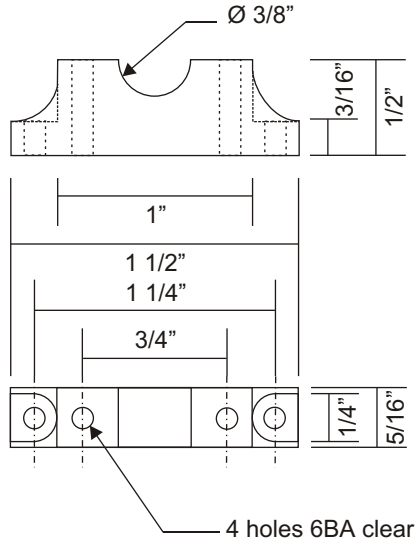

Fig. 19 Bearing Block
MS 2 off

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A Lancashire Mill Engine

Crankshaft & Bearings

Scale: 1:12 1st Angle Projection

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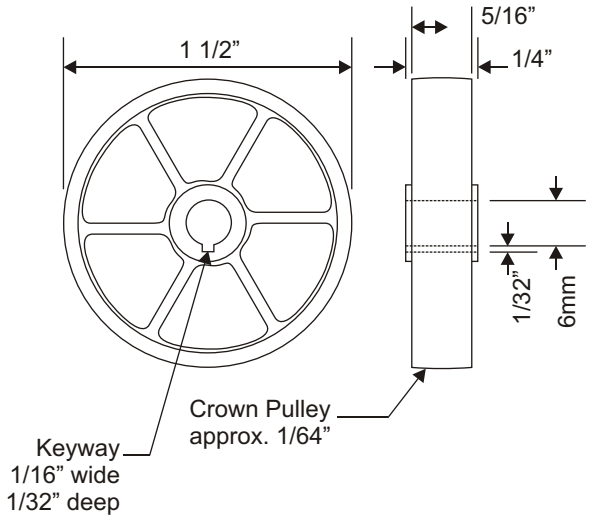

Fig. 13 Inner Pulley
CI

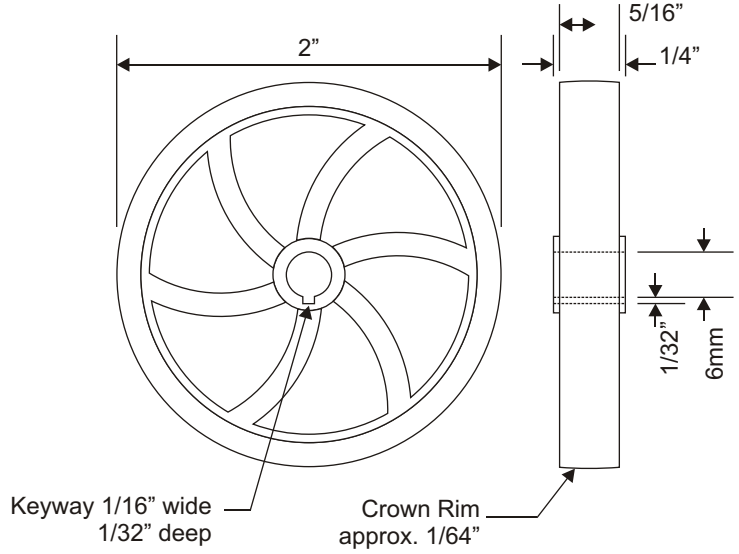

Fig. 12 Outer Pulley
CI

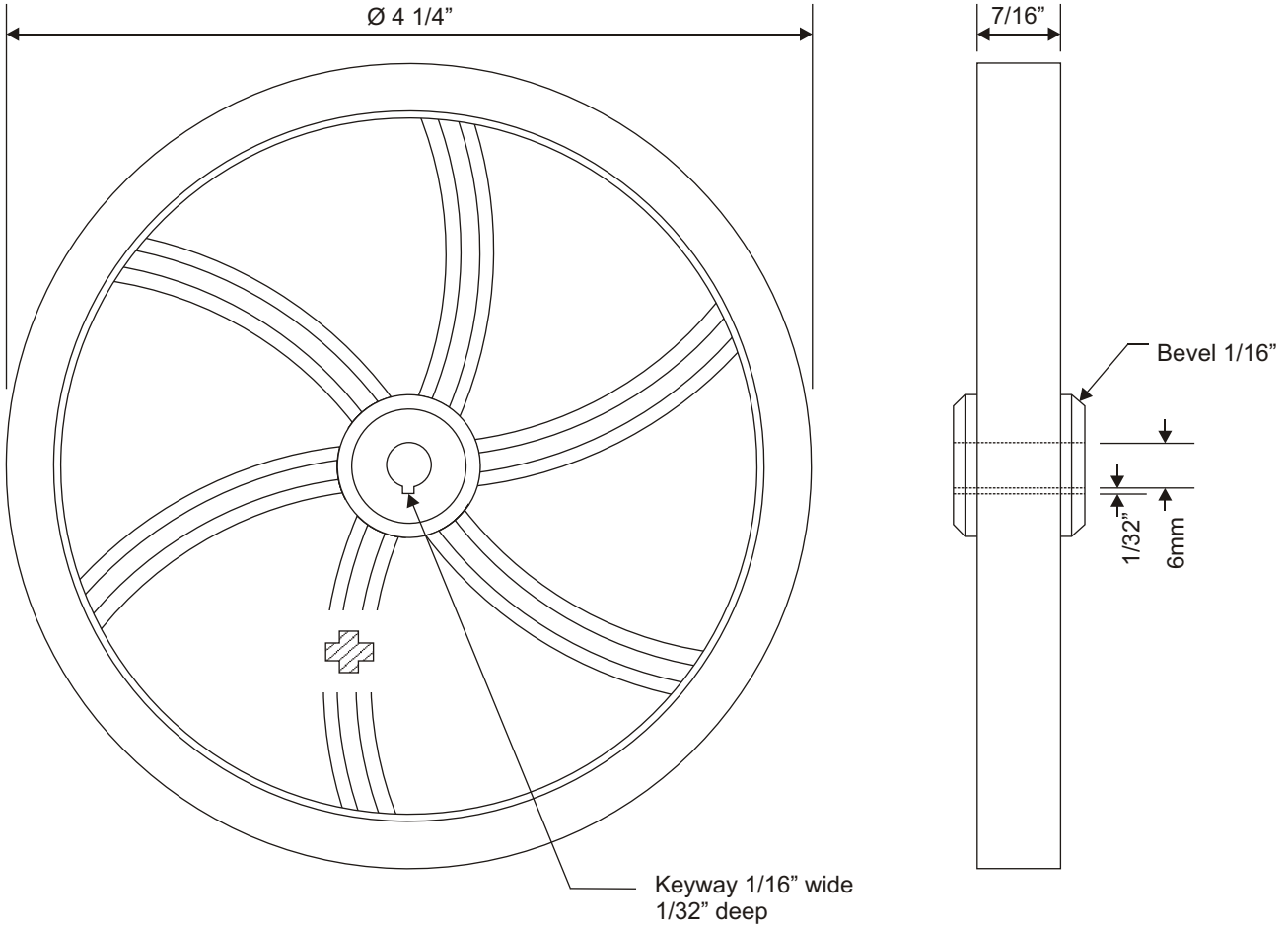

Fig. 11 Flywheel
CI

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A Lancashire Mill Engine

Flywheel & Pulleys

Scale: 1:12 1st Angle Projection

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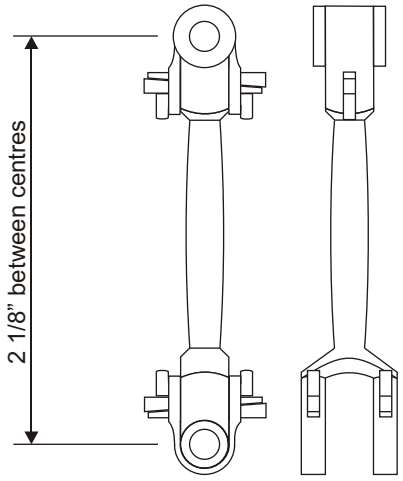


Fig. 22 Connecting Rod
General Arrangement

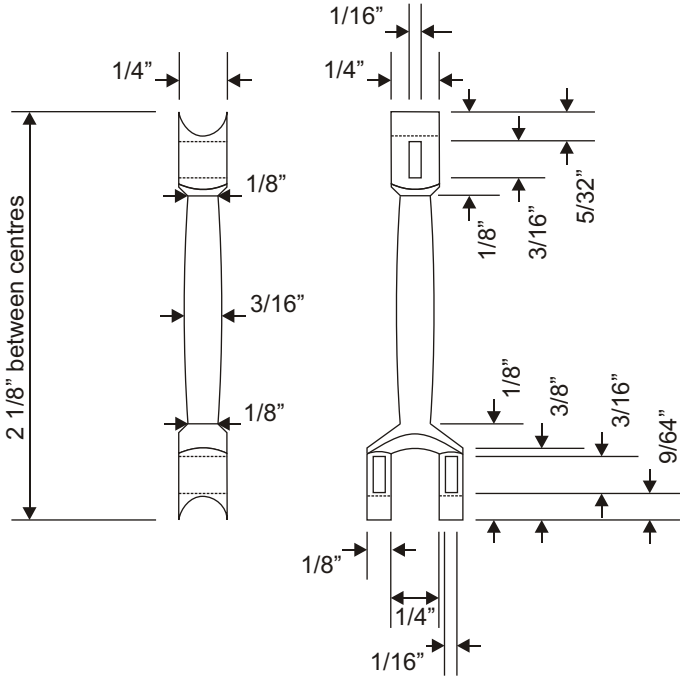


Fig. 23 Connecting Rod
MS

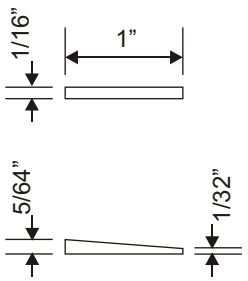


Fig. 26 Wedges
MS, 6 off

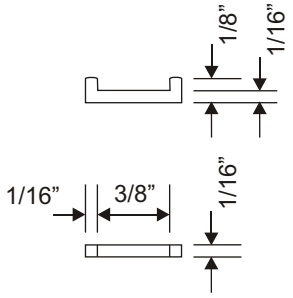
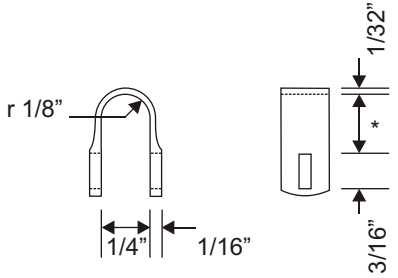


Fig. 27 Cotter
MS, 4off



*Adjust distance
to match slots in
connecting rod

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

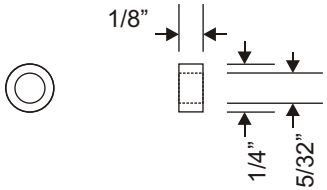


Fig. 24 Little End Bush
Bronze, 2 off

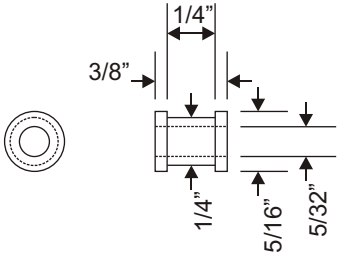


Fig. 25 Big End Bush
Bronze

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A Lancashire Mill Engine

Connecting Rod

Scale: 1:12 1st Angle Projection

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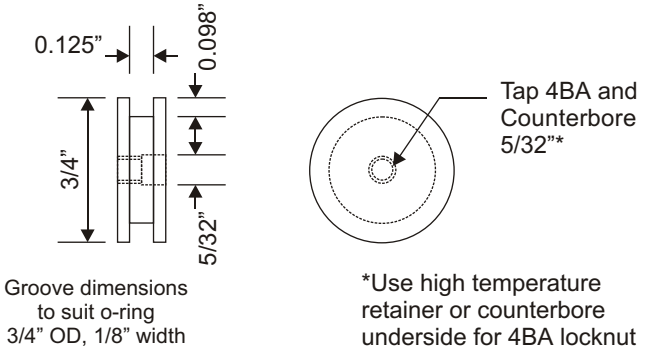

Fig. 33 Piston
Brass or GM

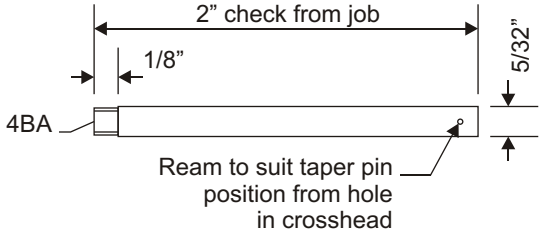

Fig. 32 Piston Rod
Stainless Steel

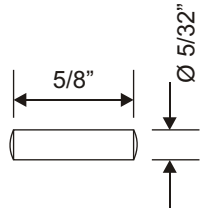

Fig. 31 Crosshead Pin
silver steel

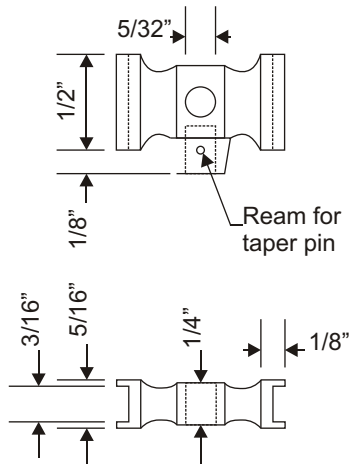

Fig. 30 Crosshead
CI or GM

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

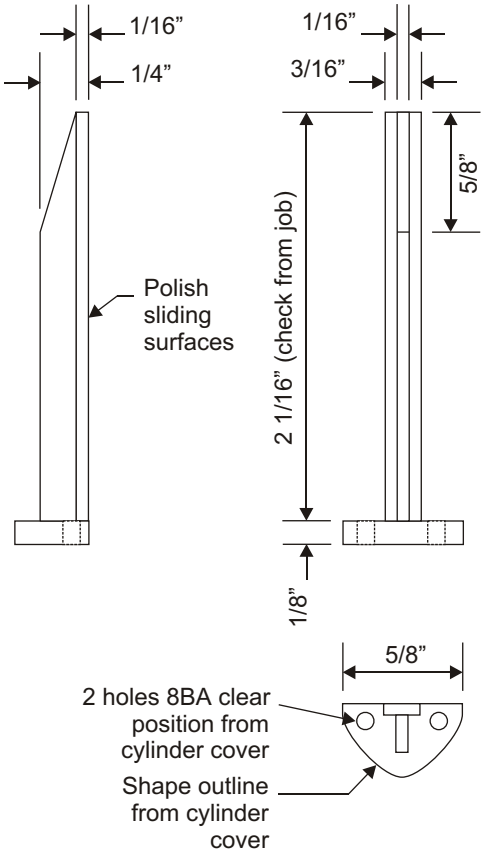

Fig. 29 Crosshead Guide Bars
MS fabrication, 2off

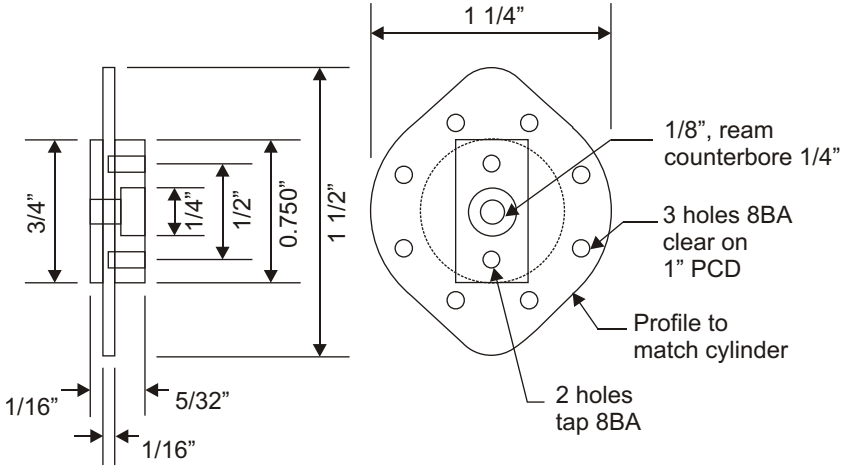

Fig. 34 Cylinder Top Cover
CI

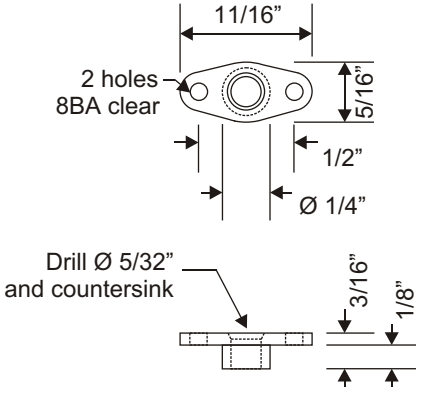

Fig. 35 Piston Rod Gland
Brass

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A Lancashire Mill Engine

Piston and Cylinder Cover

Scale: 1:12 1st Angle Projection

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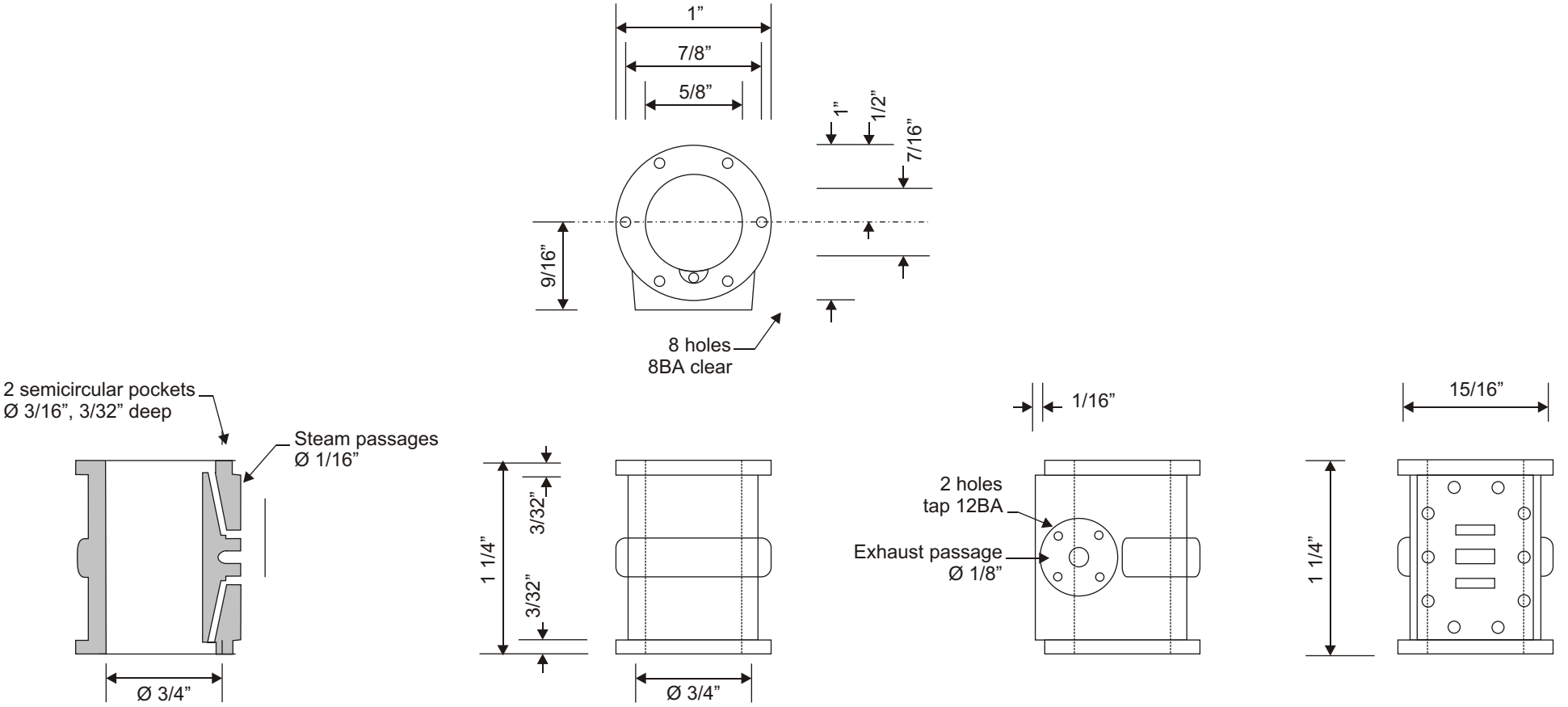

Cylinder
Cross section of port face

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’.

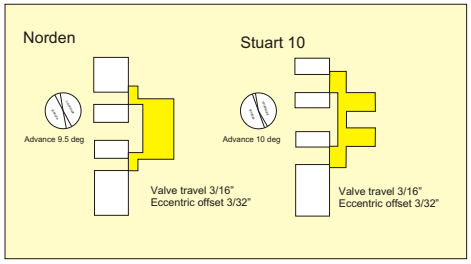

Fig. 36a Comparison of valve events
with Stuart No. 10V
Note late cut-off and minimal
expansive working in both cases

Norden

A Lancashire Mill Engine

Cylinder

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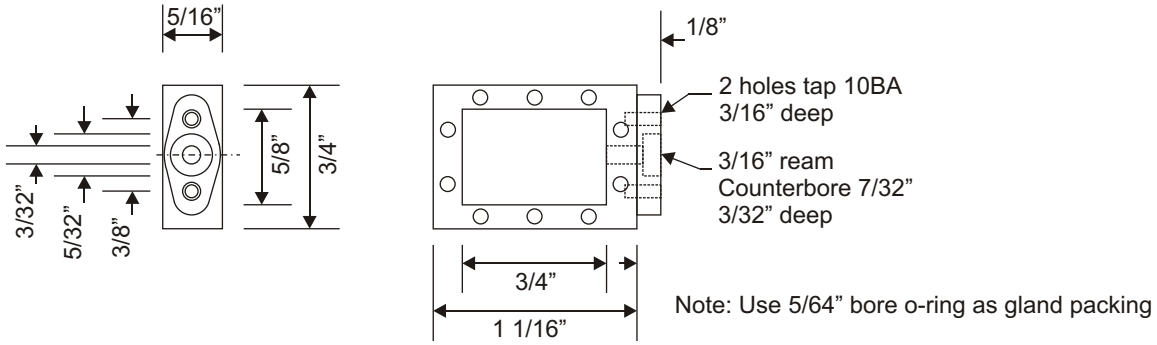
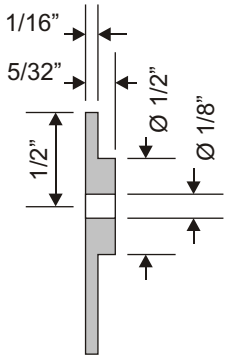
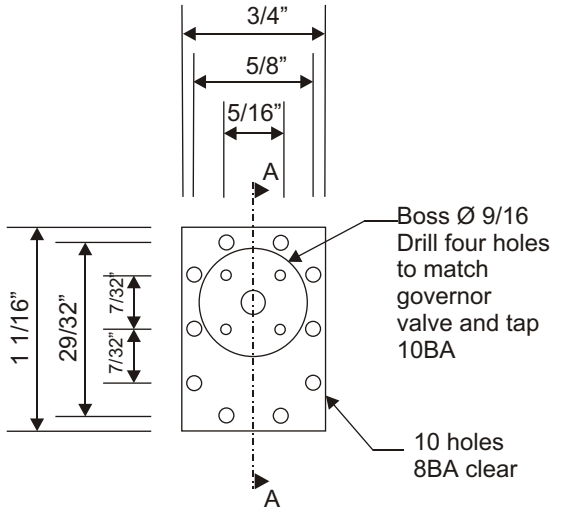


Note: Use 5/64" bore o-ring as gland packing

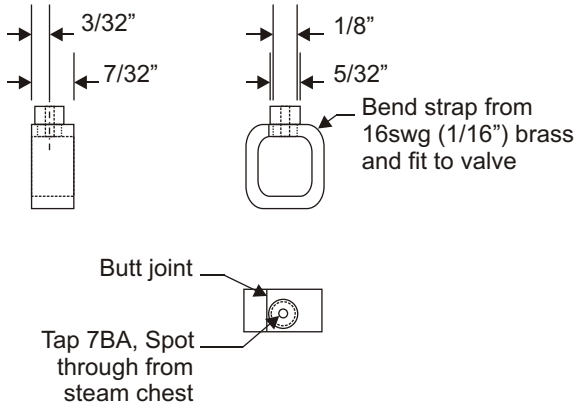
Steam Chest, Cast Iron



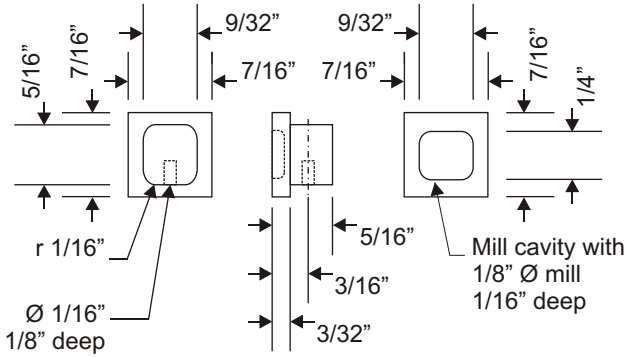
T/S A-A



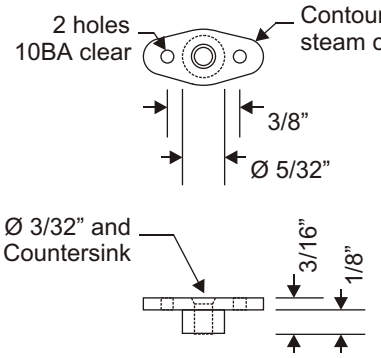
Steam Chest Cover
C.I.



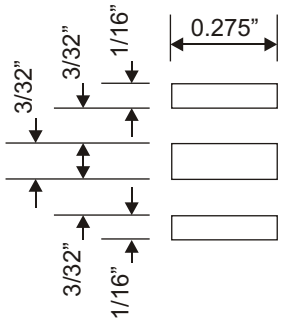
Valve Strap
Brass Fabrication



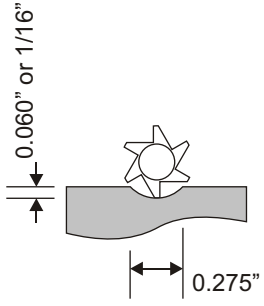
Valve, Brass or Bronze



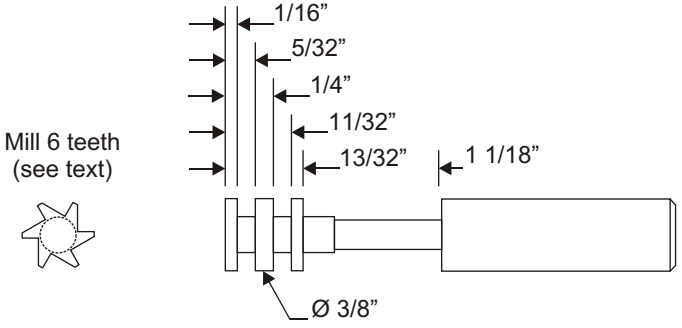
Valve Rod Gland
Brass



Valve Port dimensions
2x actual size



Cutter Infeed
for Valve Ports



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

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A Lancashire Mill Engine

Steam Chest & Valve

Scale: 1:12 1st Angle Projection

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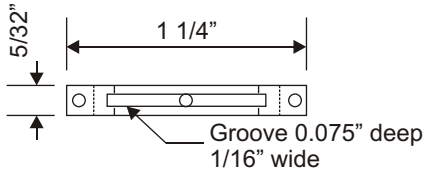
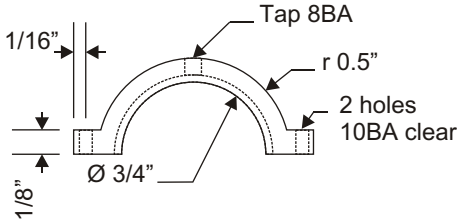
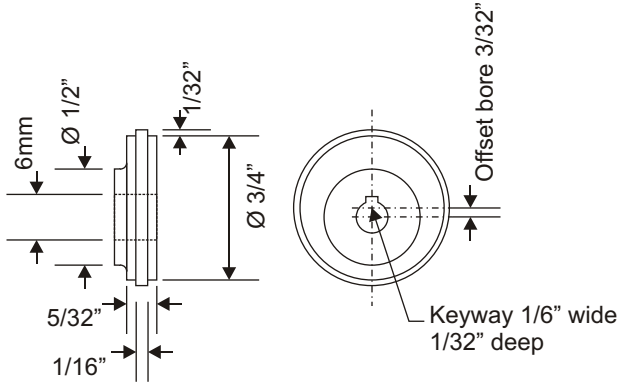




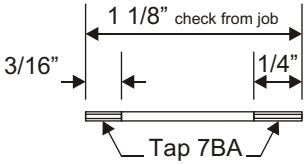
Eccentric Strap, Top
CI or Brass



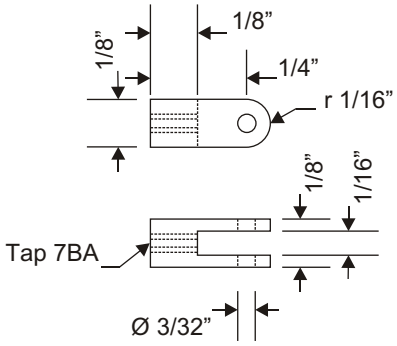
Eccentric
CI or Brass

Valve travel 3/16”
Eccentric offset 3/32”

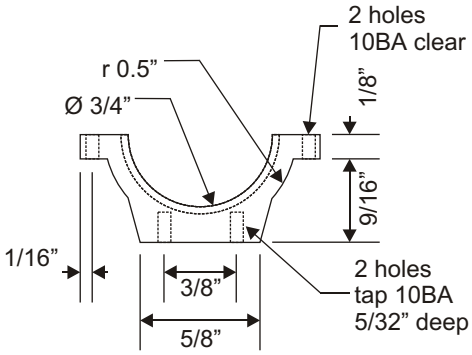
Note: 7BA threads for valve rod can be replaced with 8BA, M2.5 or 3/32” x 40 tpi to suit equipment available

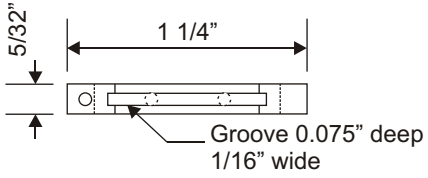


Valve Rod
3/32” Stainless Steel

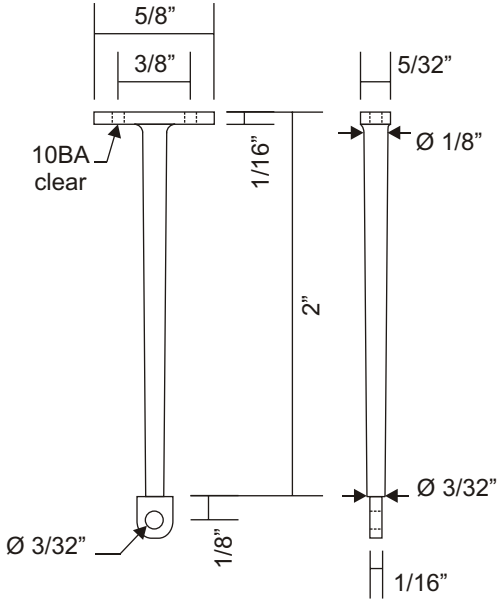


Valve Rod Knuckle
x2 Brass

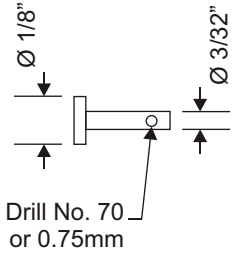




Eccentric strap, Bottom
CI or Brass



Valve Connecting Rod
MS Fabrication



Valve Rod Knuckle Pin
x2, MS

Norden

A Lancashire Mill Engine

Valve Gear

Scale: 1:12 1st Angle Projection

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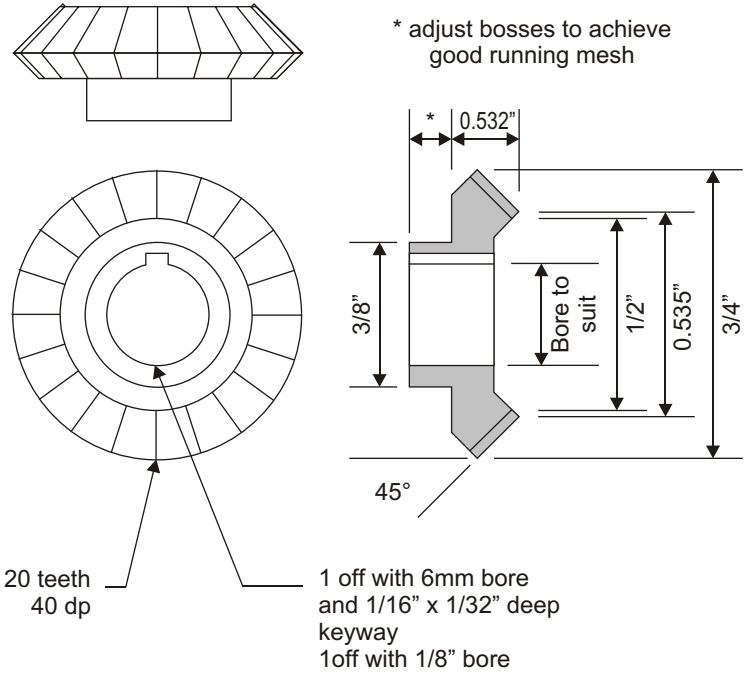


Governor Bevel Gear
X2, Brass, MS or CI, 2 off

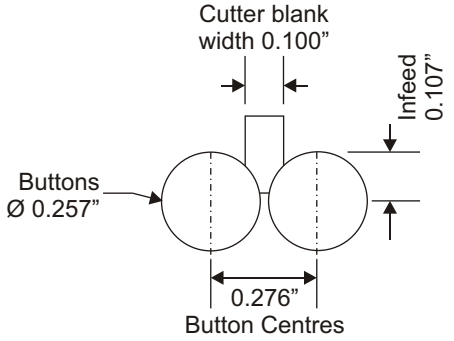
Note: Any pair of matching 45° bevel gears with an overall diameter of about 3/4” and bosses that can be bored to size may be used.

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.



Form tool for gear cutters
X2

Norden

A Lancashire Mill Engine

Bevel Gears

Scale: 1:12 1st Angle Projection
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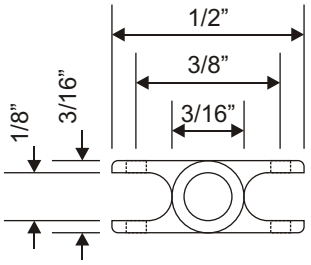
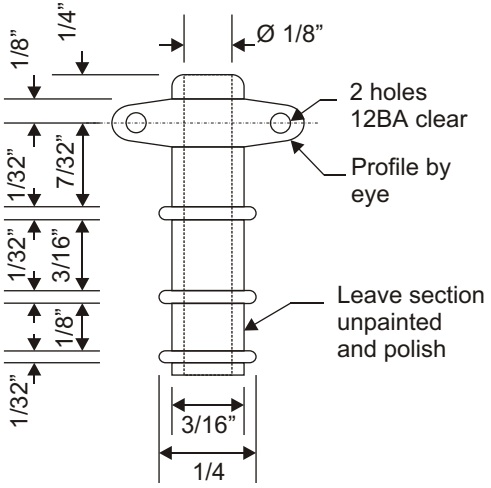
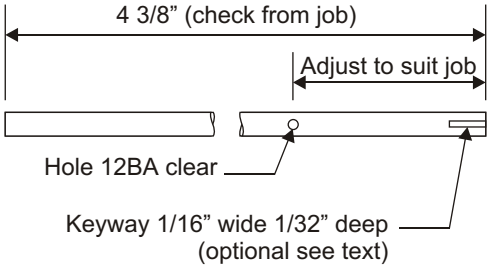
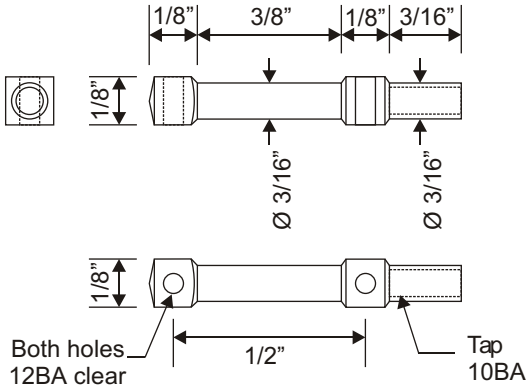




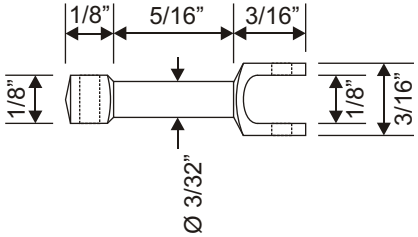
Lower (moving) Sleeve
x2,Brass



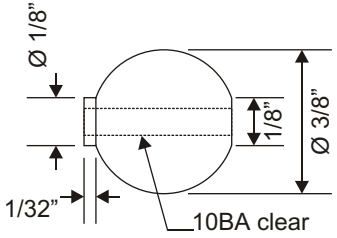
Governor Spindle
MS or Silver Steel



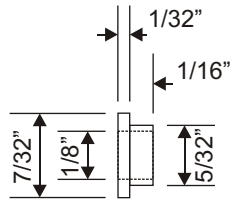
Upper Swing Arm
X2, Mild Steel, 2off



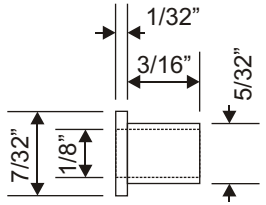
Lower Swing Arm
X2, Mild Steel, 2off



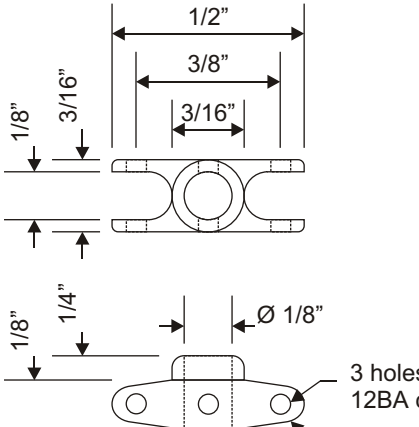
Governor Weights
2x, Brass, 2 off



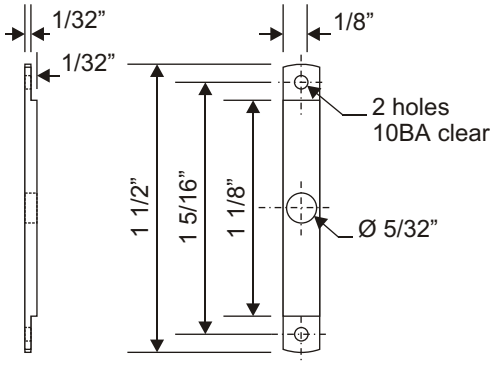
Upper Spindle Bearing
X2, Brass



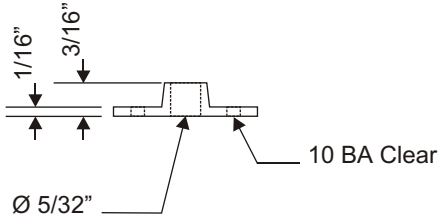
Lower Spindle Bearing Bush
2x, Brass



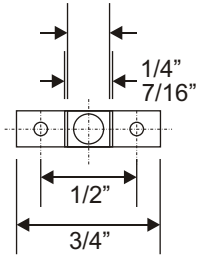
Upper (fixed) Sleeve
x2,Brass



Governor Support Bar
MS



Note: Place 1/8”
ball bearing inside
lower bearing bush



Bottom Bearing Housing
MS or CI

Norden

A Lancashire Mill Engine

Governor 1 - rotating parts

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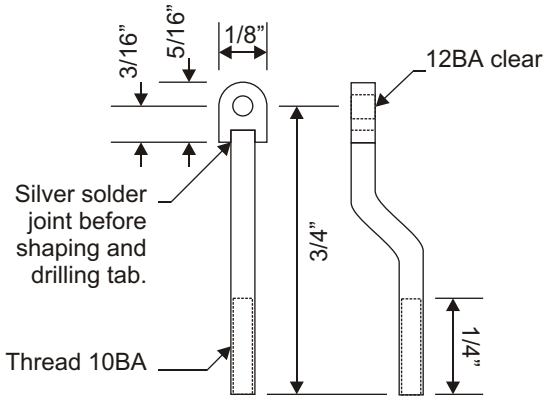
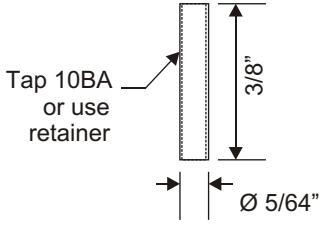
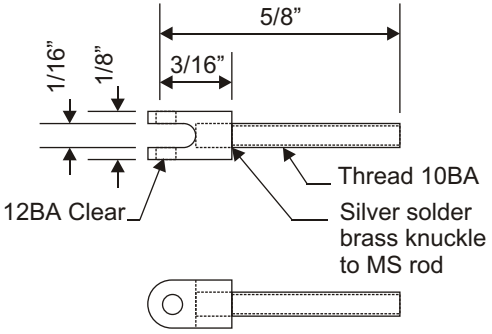


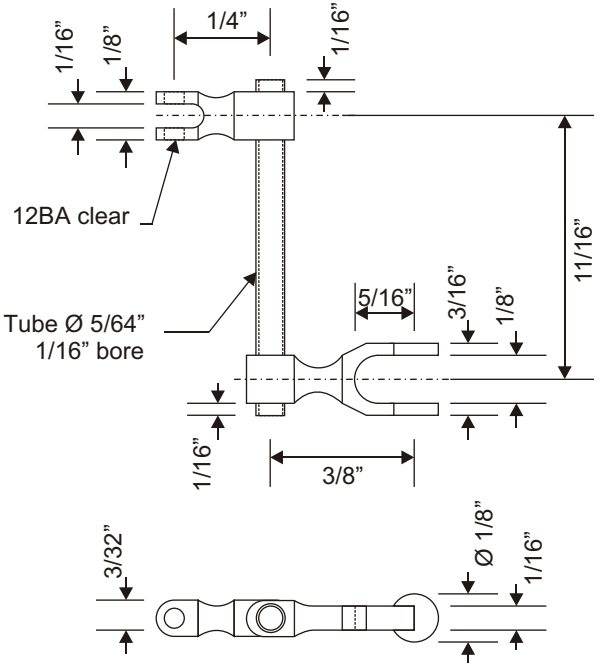
Upper Lifting Link
X2, Brass fabrication



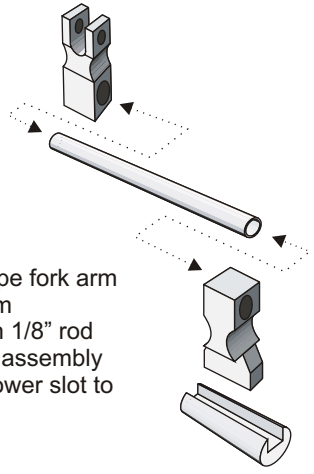
Lifting Link Adjuster
X2, Brass



Lower Lifting Link
X2, Brass & MS fabrication

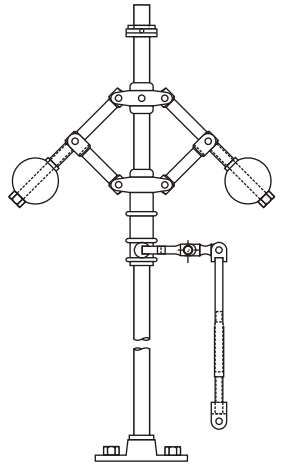


Governor Fork Assembly
X2, Brass fabrication

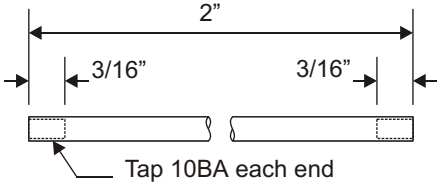


1) Roughly shape fork arm and follower arm
2) Mill groove in 1/8" rod
3) Silver solder assembly
4) Machine follower slot to leave two pads
5) Hand finish

Governor Fork Tube
Assembly Guide



Governor
General Arrangement
not to scale



Governor Lever Shaft
X2, 1/16" Ø MS

Norden

A Lancashire Mill Engine

Governor 2 - linkages

Scale: 1:12 1st Angle Projection
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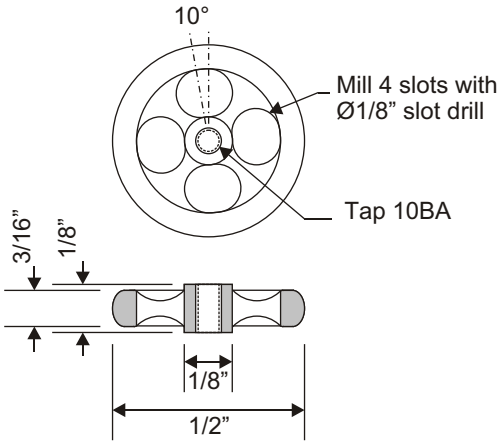
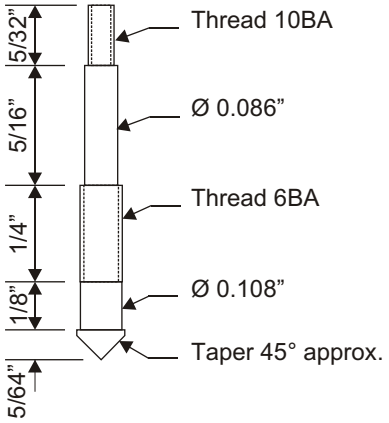
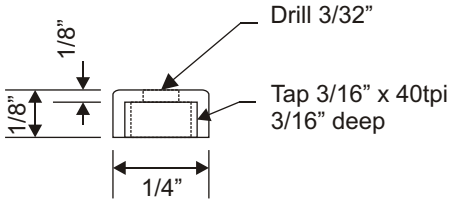


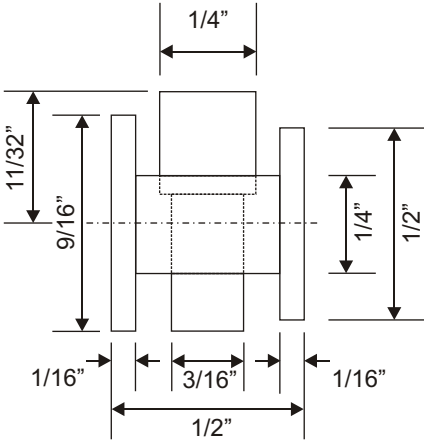
Stop Valve Handwheel
X2, Brass



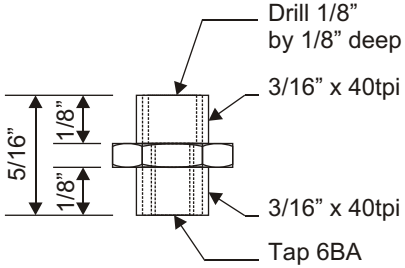
Valve Spindle
X2, Stainless Steel



Gland Nut
X2, Brass

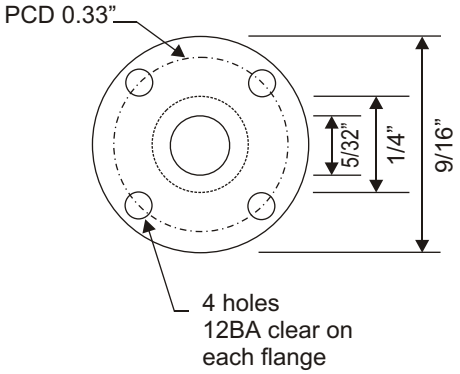


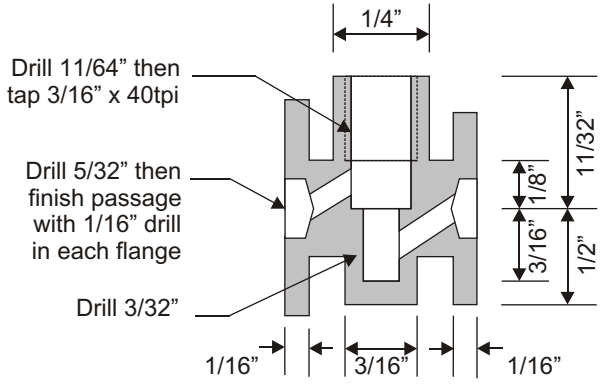
Stop Valve Body
Method of fabrication



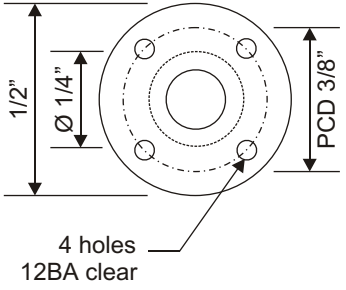
Stop Valve Gland
X2 1/4” AF Brass Hexagon

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





Steam Stop Valve Body
X2, Brass fabrication



Norden

A Lancashire Mill Engine

Steam Stop Valve

Scale: 1:12 1st Angle Projection

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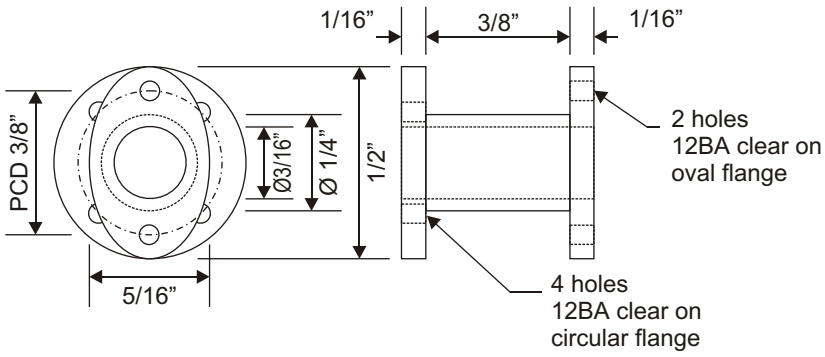
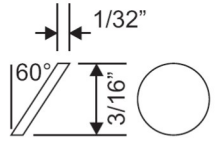
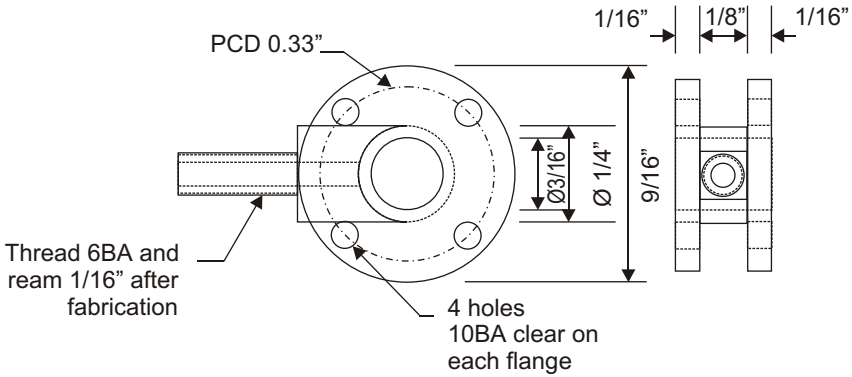


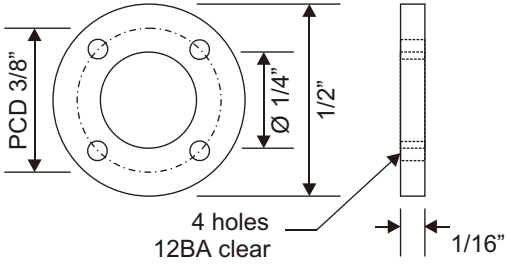
Exhaust Stub
X2, Brass



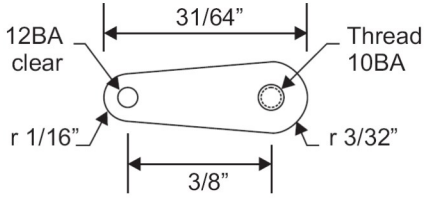
Valve Butterfly
X2, Slice of 3/16” Brass Bar



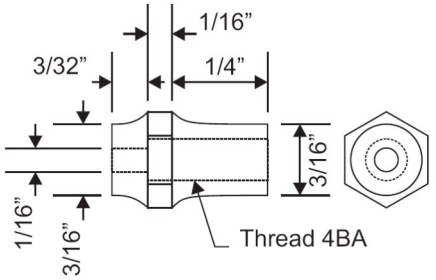
Governor Valve Housing
X2, Brass Fabrication

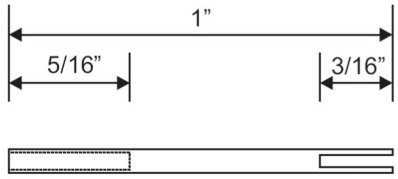


Pipe Flanges
X2, Brass, 4 off

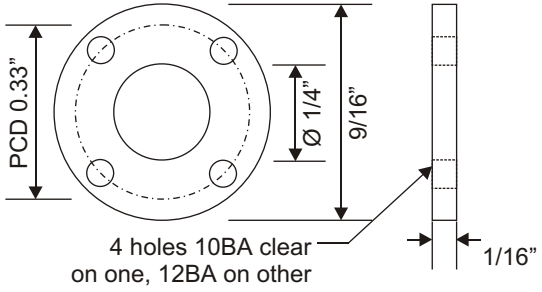


Governor Valve Lever
X2, MS 1/16” thick





Governor Valve Spindle
X2, Stainless Steel, Ø 1/16”



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

Scale : 1:12 1st Angle Projection

Date: 02/2009

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