T H E S I S.

Design of a Twenty-ton Traveling Crane, the power for which is to be furnished by compressed air.

The Crane is to have a span of 40' - 0". It is to travel on a track 30' high and of any length, depending on the length of shop in which it is to be used.

Beams.

There are to be two beams.

Calculations for beam.

We know that the maximum bending moment of a beam is at the middle section considering the load as being concentrated at the center of the span.

We get an equation

$$\frac{-16000I}{c} = -50000x^2 + \frac{50000x}{e}$$

in which 16000 is safe stress in the metal and a load of 50000 lbs. to take account of any extra loading that may take place.

Now the Moment of Inertia may be found after knowing the thickness of web plates, flange plates, and angle iron. But these are not known, so taking them from some similar

design we find good values of them to be:

Web plates = $\frac{1}{2}$" x 33"

Flange plates = $\frac{3}{8}$ x 20"

Angle irons = 3".

Hence we know everything except the height of the beam. Substituting for the value $\frac{I}{c}$ in equation (1) and solving for the height, we get it to be 27". But this value seems to be far too little than what is used in practice, so it is decided to use a 33" box girder. The reason that the calculations do not agree with practice is supposed to be due to the fact that the rivets were not taken into account.

Hoisting Gear.

It is desired to raise the maximum weight with a speed of 10 feet per minute. Hence the H.P. needed to raise it will be:

$$\frac{40000 \times 10}{33000} = 12 \text{ H.P.}$$

But it may be assumed very reasonably that 50% of the power will be lost in friction. Hence a 25 H.P. motor will be required.

Gear Wheels.

Gear Wheels.

1st Pinion:

N = 200. H.P. = 25. Diameter of shaft = $2\frac{1}{4}$".

W = width of face. Diameter = 5.73. Pitch = 1.5".

W = 3" N = 12.

1st Spur Wheel:

P = 1.5. D = 26. W = 3". N = 54. Diameter of Shaft = 3".

Spokes to be six in number. Elliptical section 4" x 2" at base. Both pinion and spur wheel to be made of cast iron.

2nd. Pinion:

P = 1.96". D = 7.5". W = 4". N = 12. Diameter of Shaft = 3".

2nd. Spur Wheel:

P = 1.96". D = 60". W = 4". N = 96. Diam.of Shaft = $4\frac{1}{2}$".

There are to be eight spokes, 7" x $3\frac{1}{2}$" at Base. Elliptical section. Both pinion and spur wheel to be made of cast iron.

Last Pinion and Wheels:

For Pinion - P = 2.6. W = 6". D = 9".

For Wheel - P = 2.6". W = 6". D = 24". Diameter of

Shaft = 7".

For Spokes - six spokes 8' x 4" at base. Both pinion and wheels to be made of cast steel.

Drum.

The Drum to be 24" in diameter and 4' - 0" long, to be grooved so that a $1\frac{3}{4}$" wire rope will fit in the groove.

Brake.

The brake will be operated by a 10" Westinghouse up-pull ing brake drum. The brake is to bear on a surface of the drum 6" wide.

Bridge Travel.

The wheels for the tracks and bridge travel are 24" in diameter. There will be two motors required for the bridge travel and the track travel.

Since the motor is only to work on one set of the wheels the tangential component will be:

T = tangential component. T = 25000 x .15, where .15 is coefficient of friction.

T = 3750. Speed = 20' per min.

$$3750 = \frac{550}{1/3} \times \text{H.P.}$$

$$\text{H.P.} = 2.5, \text{ nearly.}$$

For Track Travel -

$$3750 = \frac{550 \times H.P.}{1}$$ Where speed = 60' per minute.

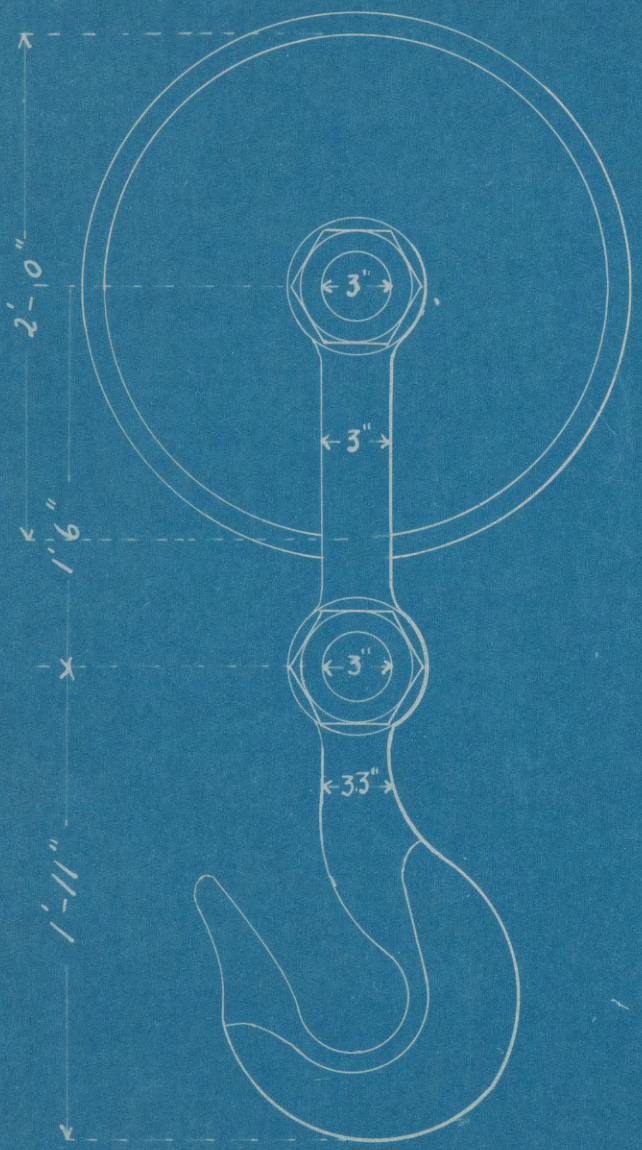
$$H.P. = 7.$$

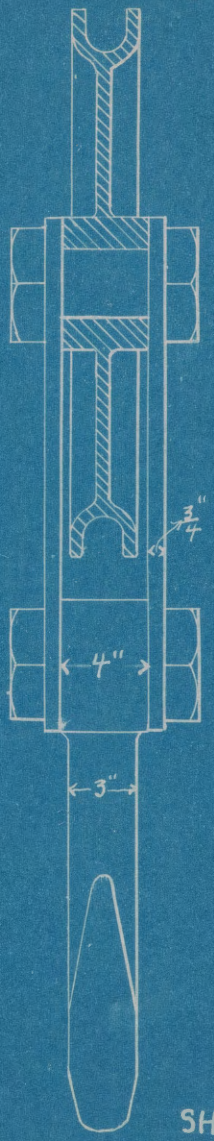
Track.

The distance between supports for the track to be 20'. The beams are T beams 24" high. The columns are made by the Carnegie steel. They are built up of 4Z bars and a narrow plate of metal. Their external dimensions are 8" x 7".

Sheave Wheel and Hook.

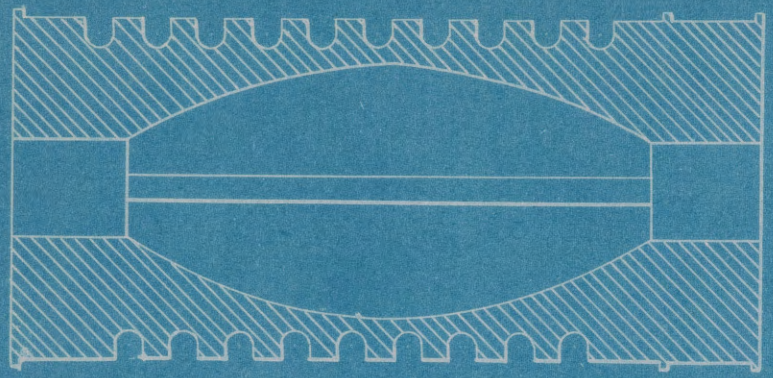
The sheave wheel is 24" in diameter for a $1\frac{3}{4}$ inch wire rope. The hook was taken from a standard design given by Unwin.

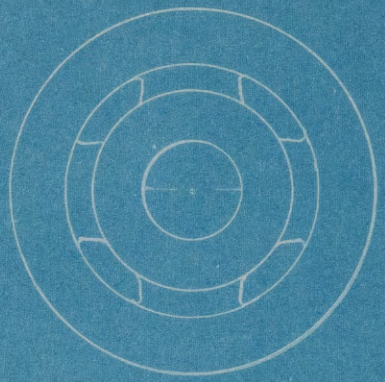


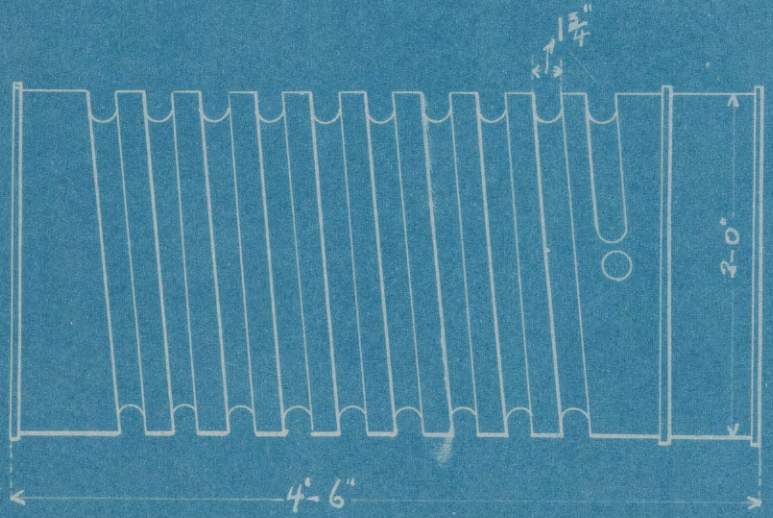


SHEAVE WHEEL AND HOOK

Scale 1½'=1"

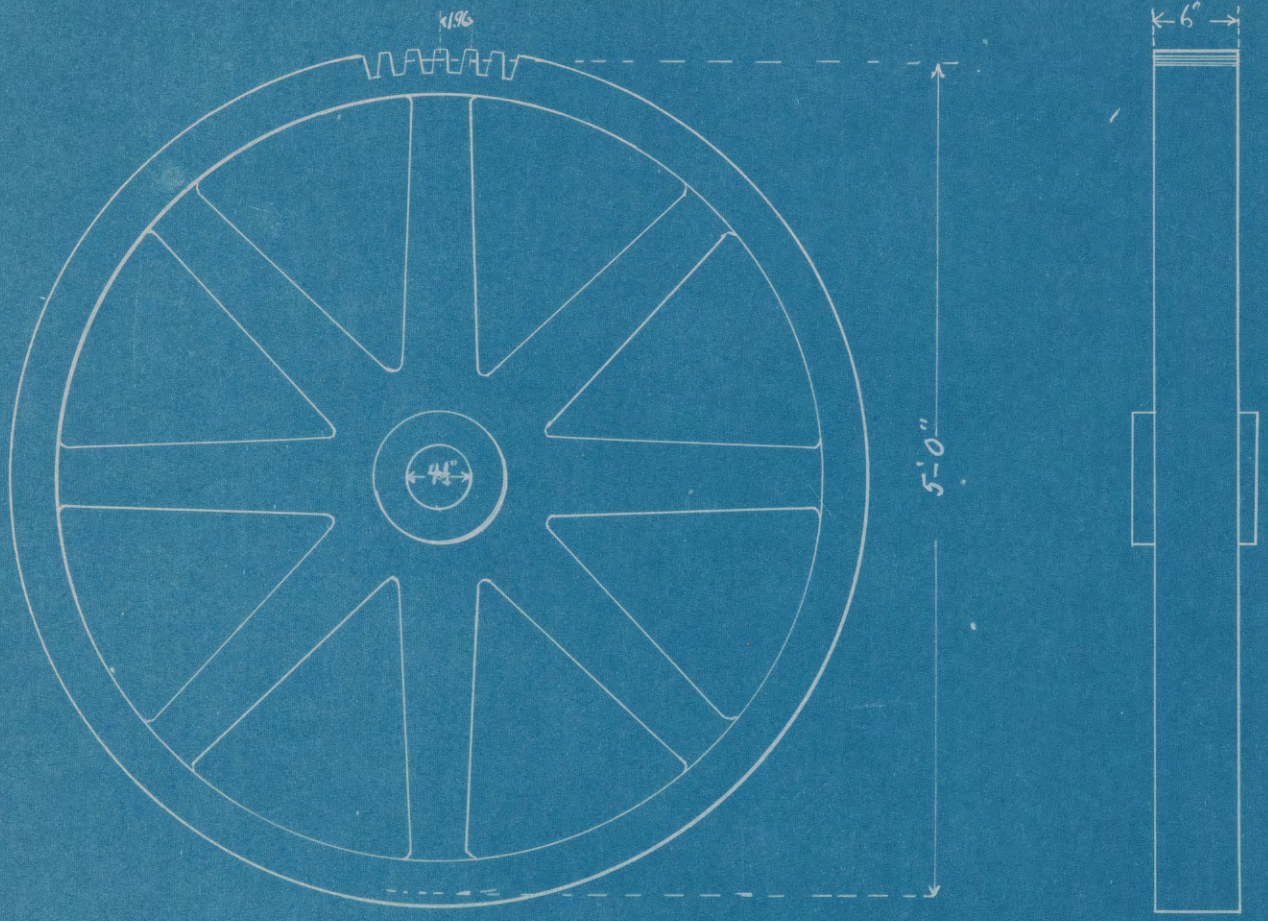






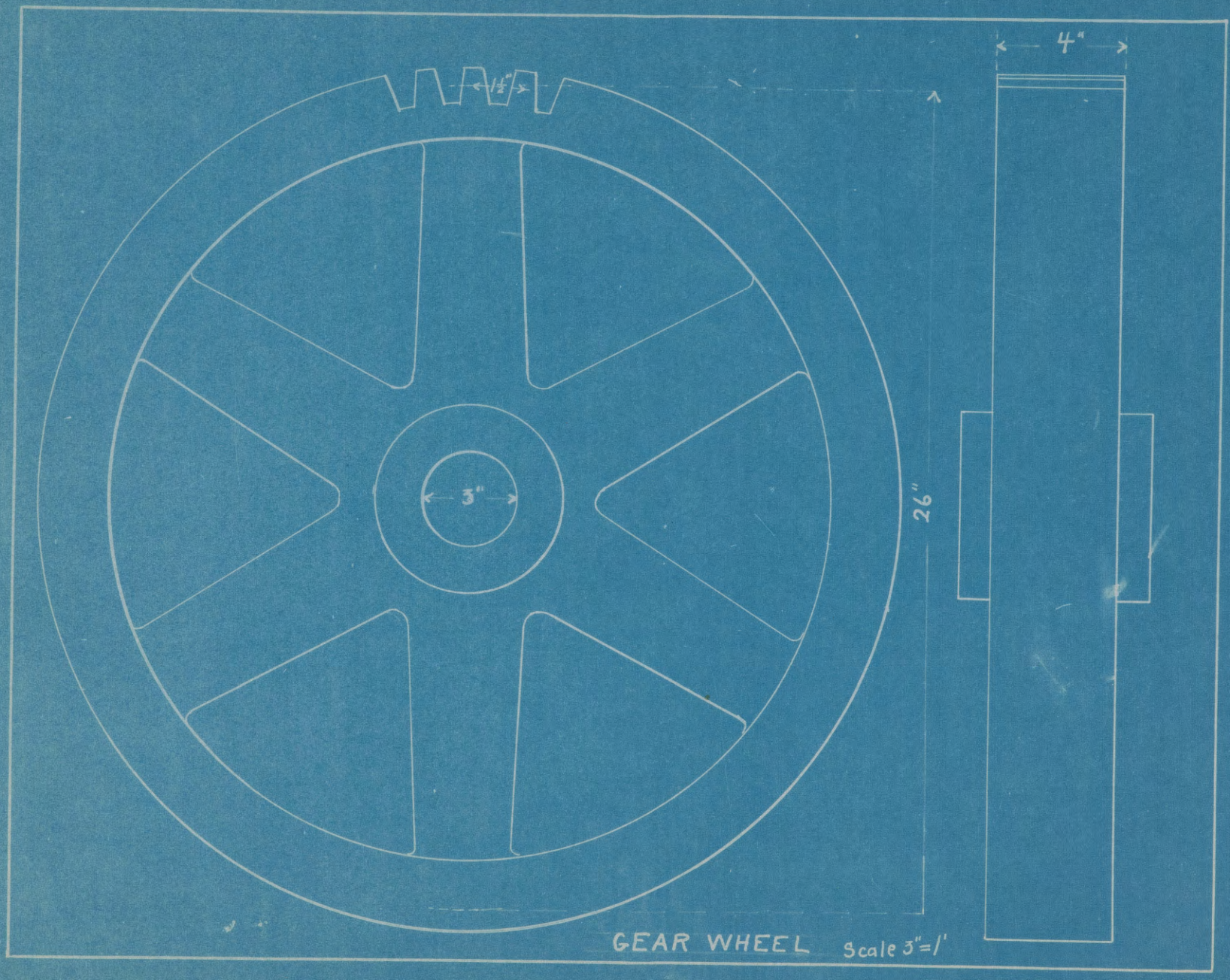
DRUM

Scale 1"=1'

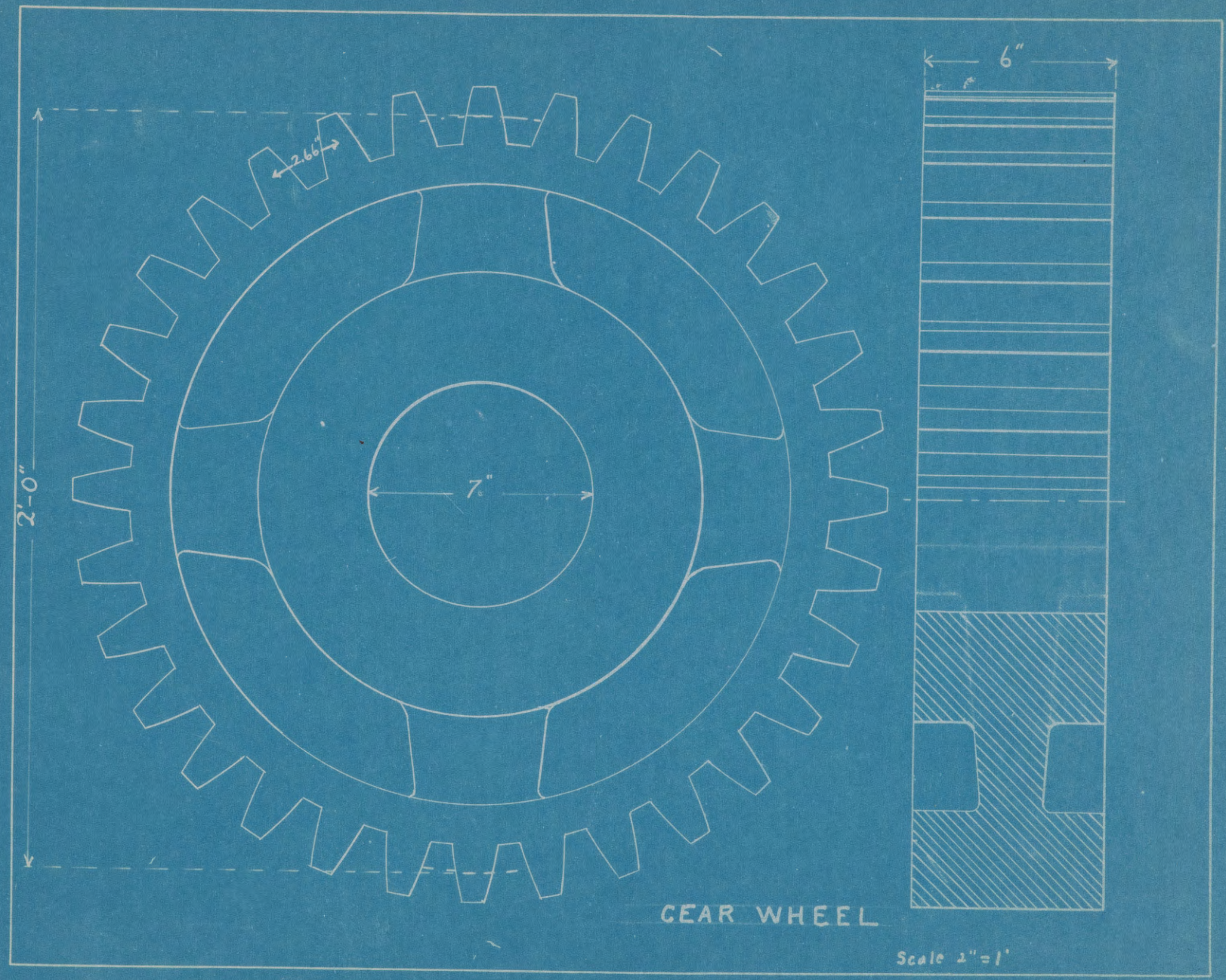


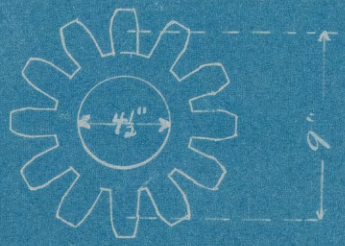
GEAR WHEEL

Scale 1" = 1'



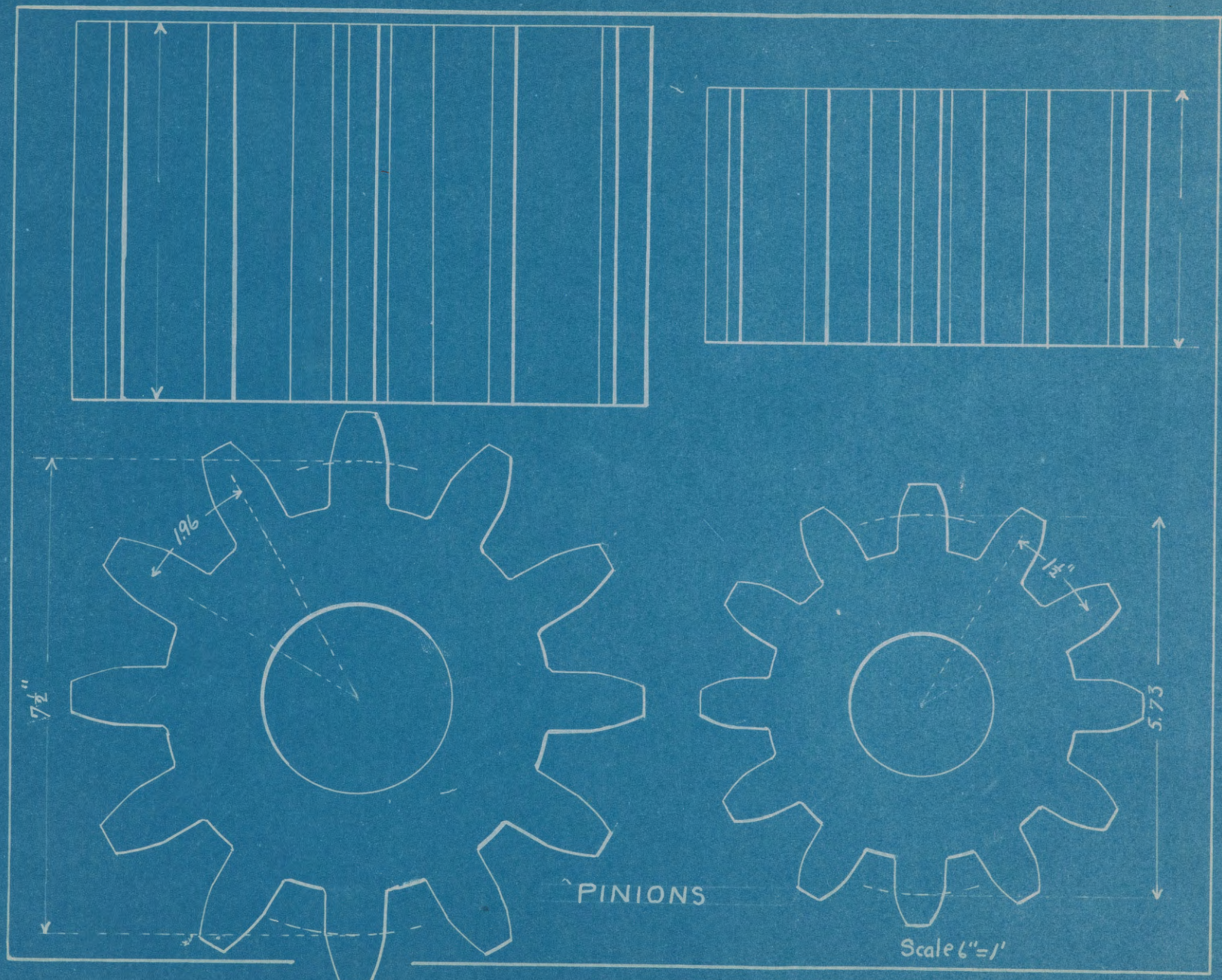
GEAR WHEEL Scale 3"=1'

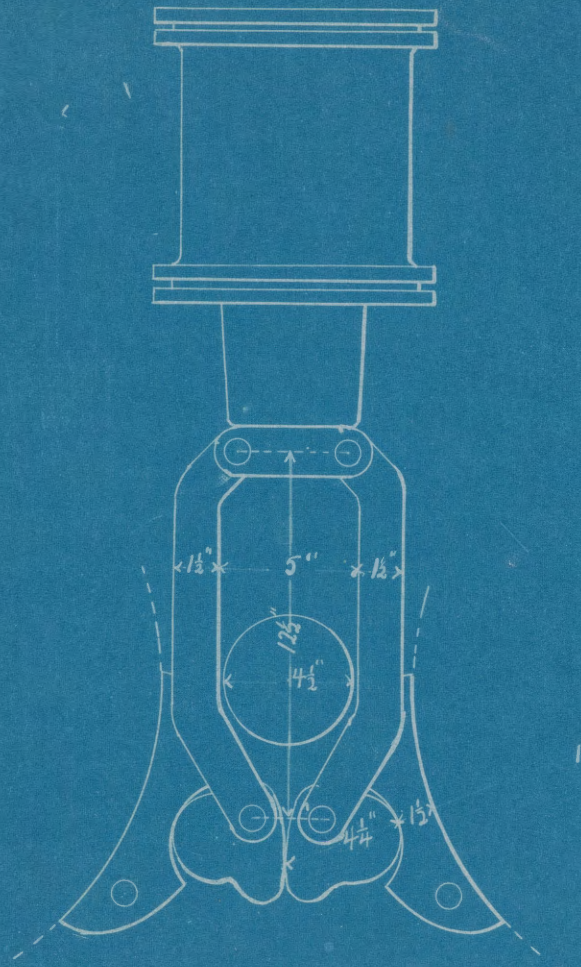

6"
2.66"
2'-0"
7"
GEAR WHEEL
Scale 2" = 1'



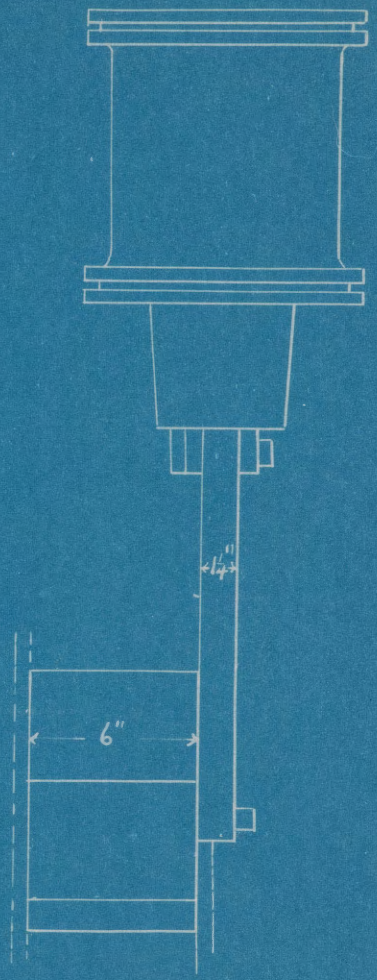
WHEEL AND PINION

Scale 1 1/2" = 1'


1.96
1.44
5.73
PINIONS
Scale 6"=1'

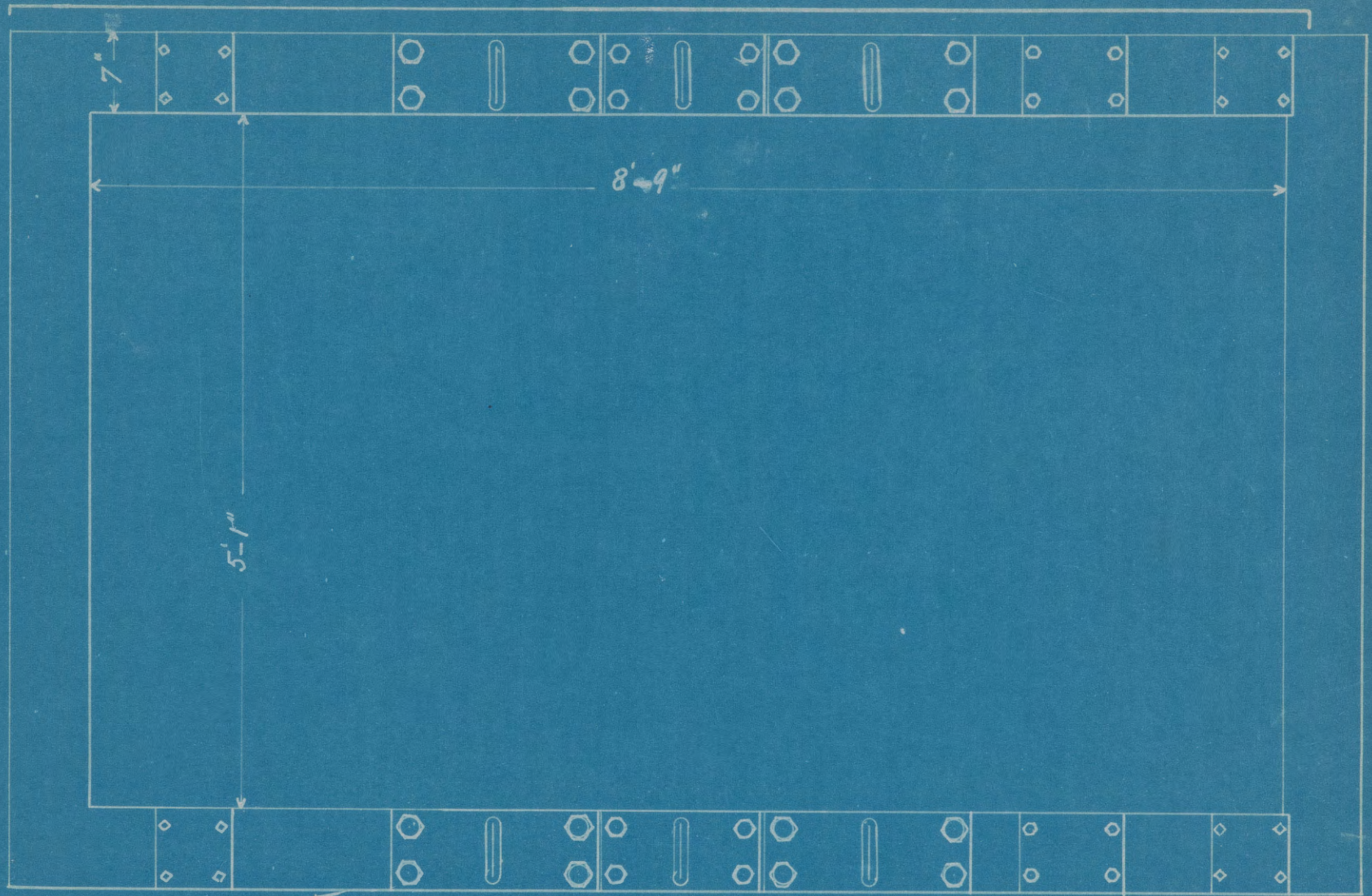


12"



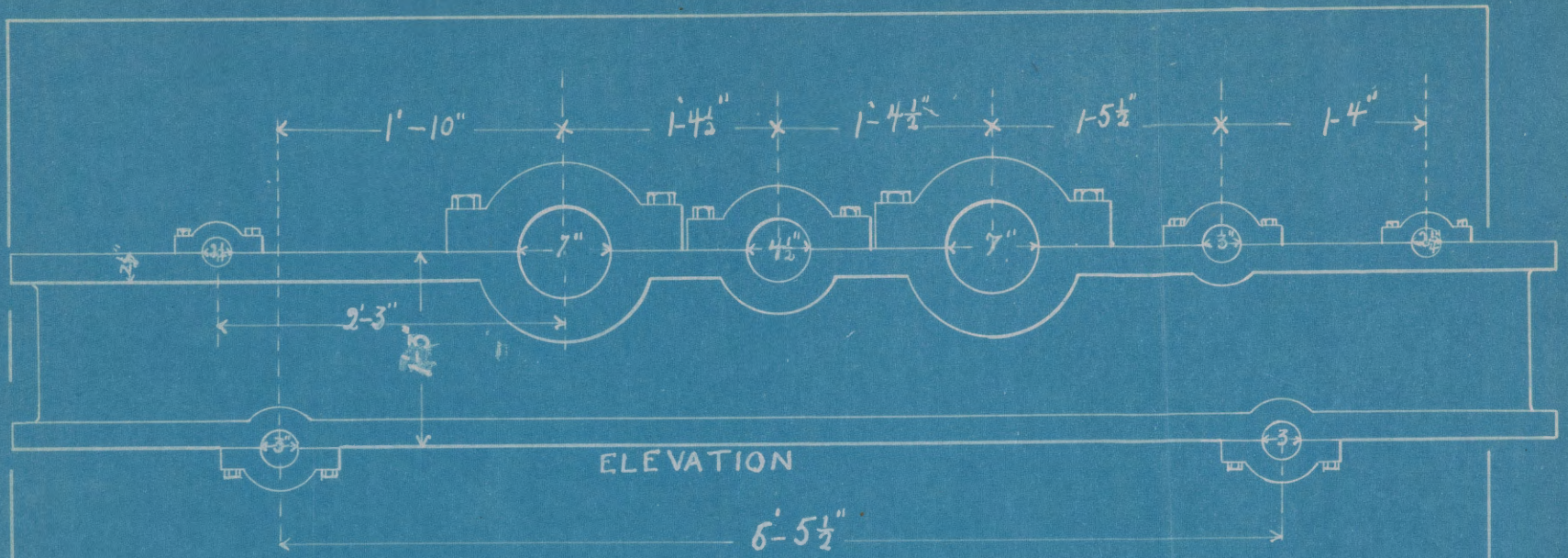
BRAKE

Scale 2" = 1'



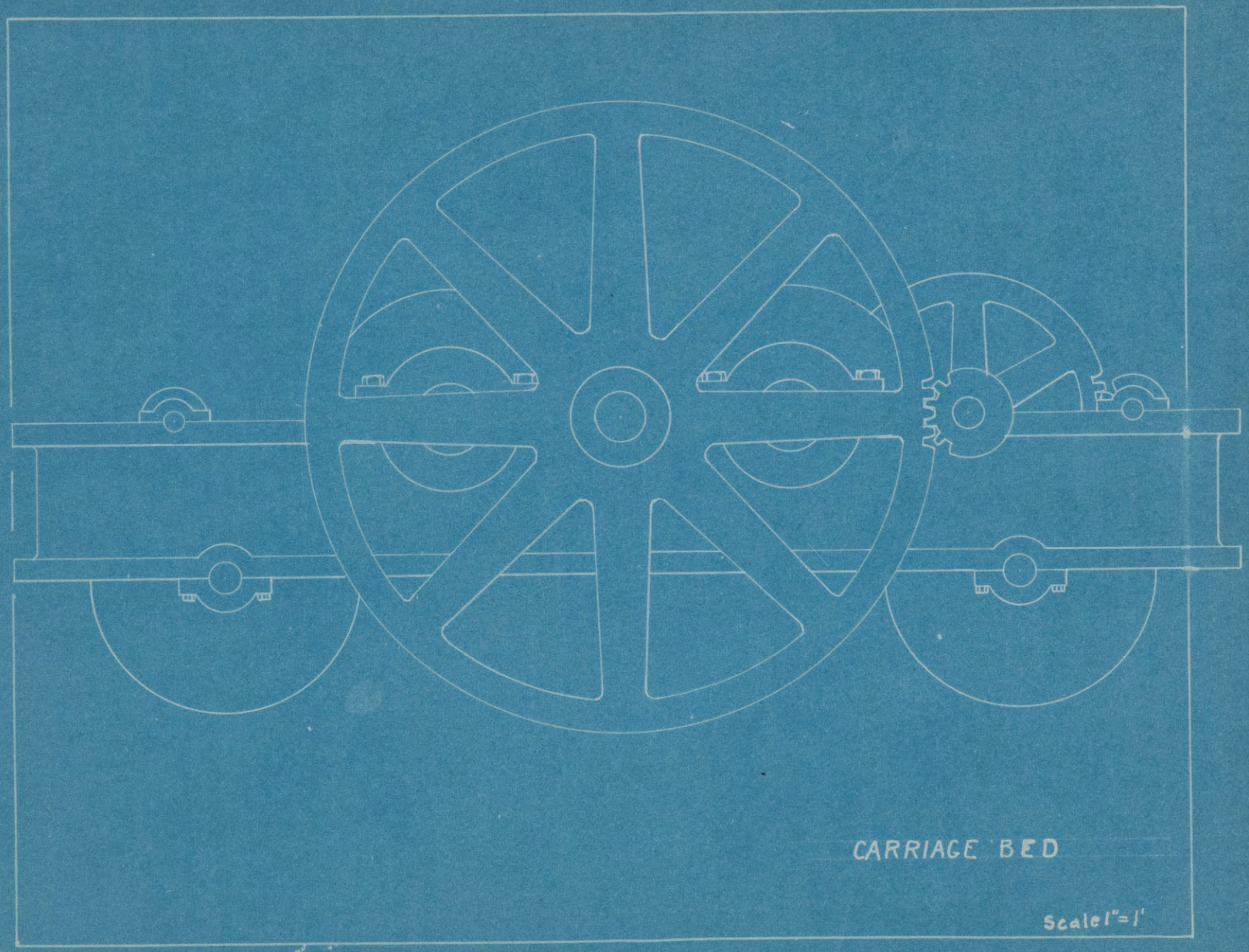
CARRIAGE BED

Scale 1"=1'



CARRIAGE BED

Scale 1"=1'



CARRIAGE BED

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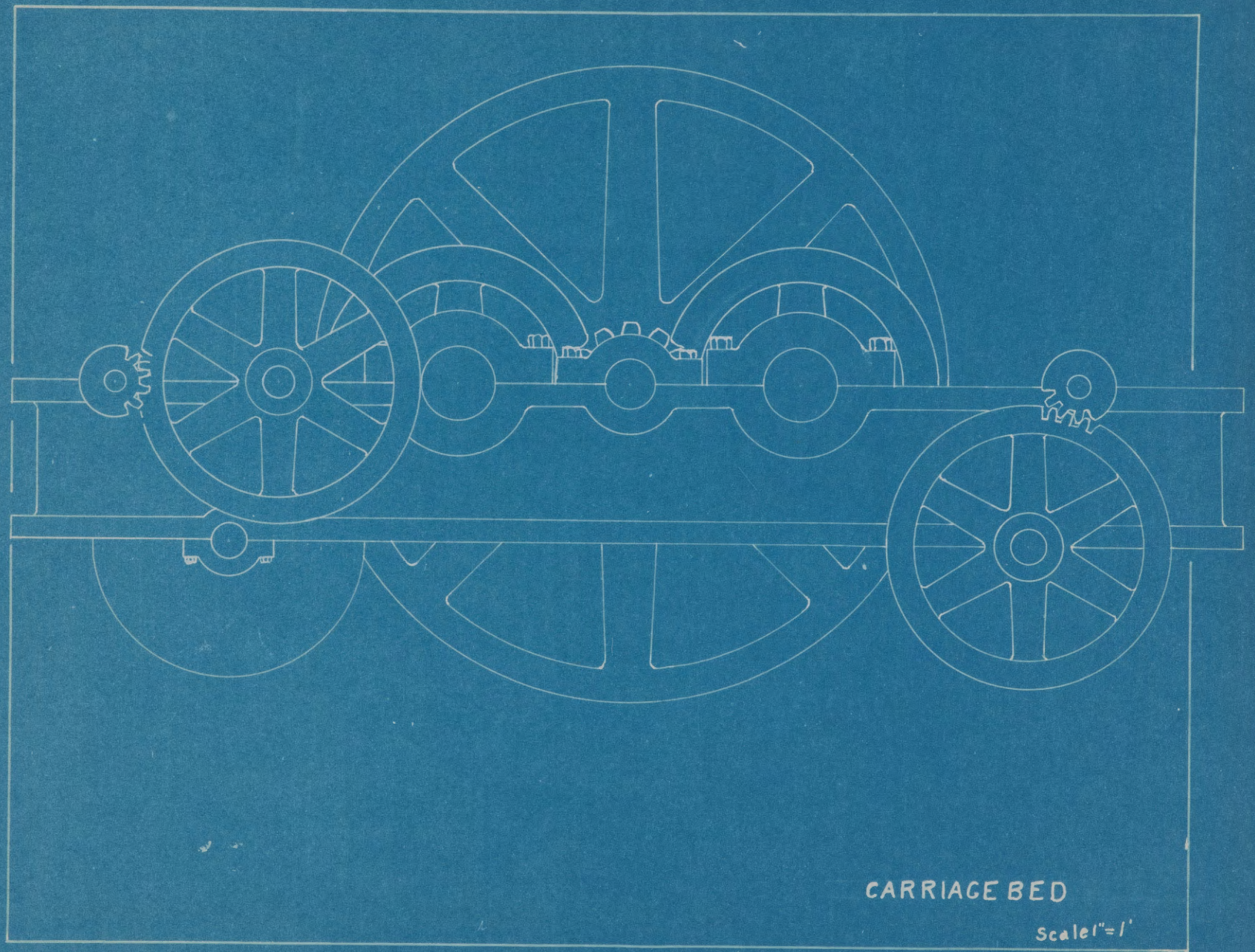
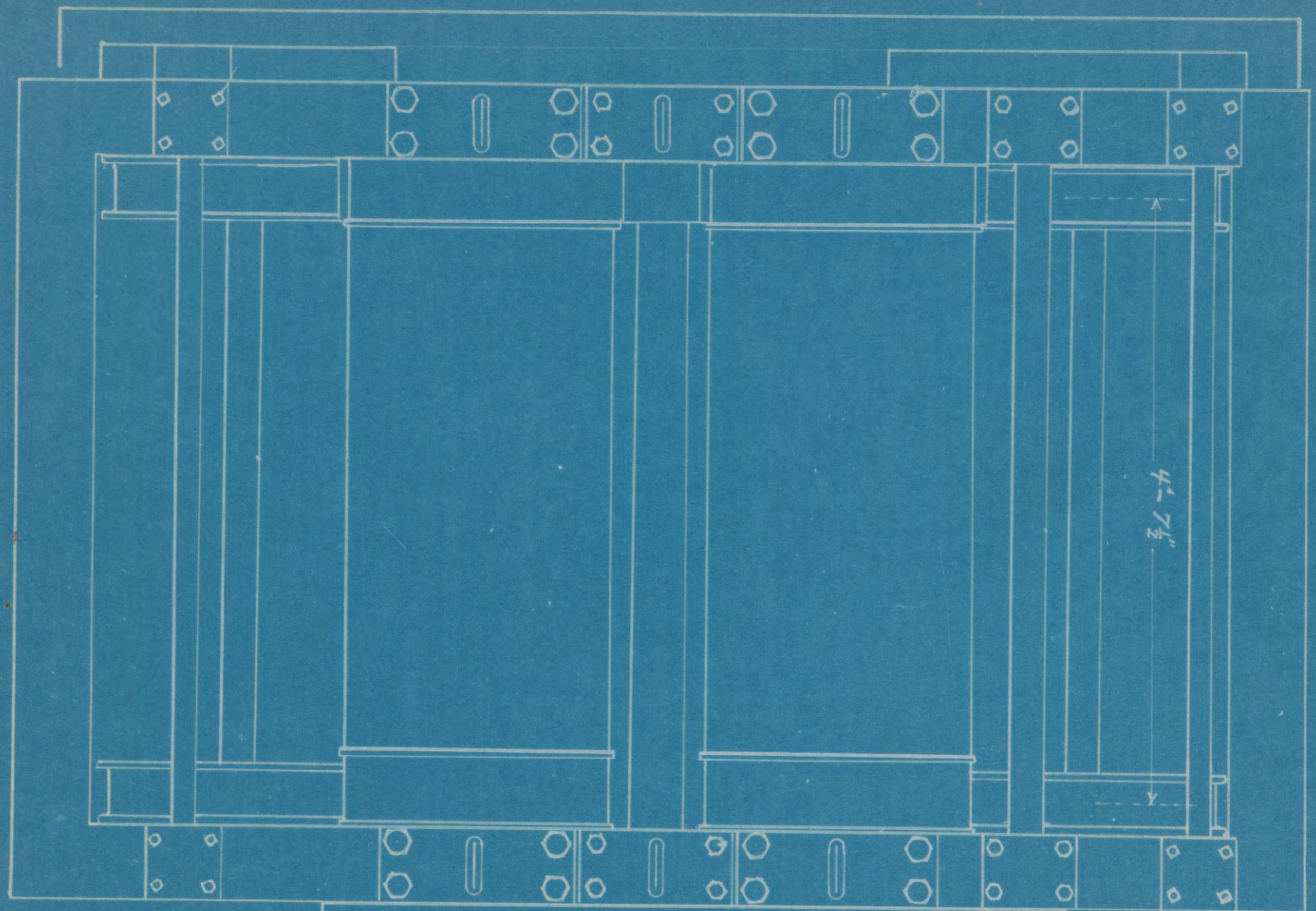
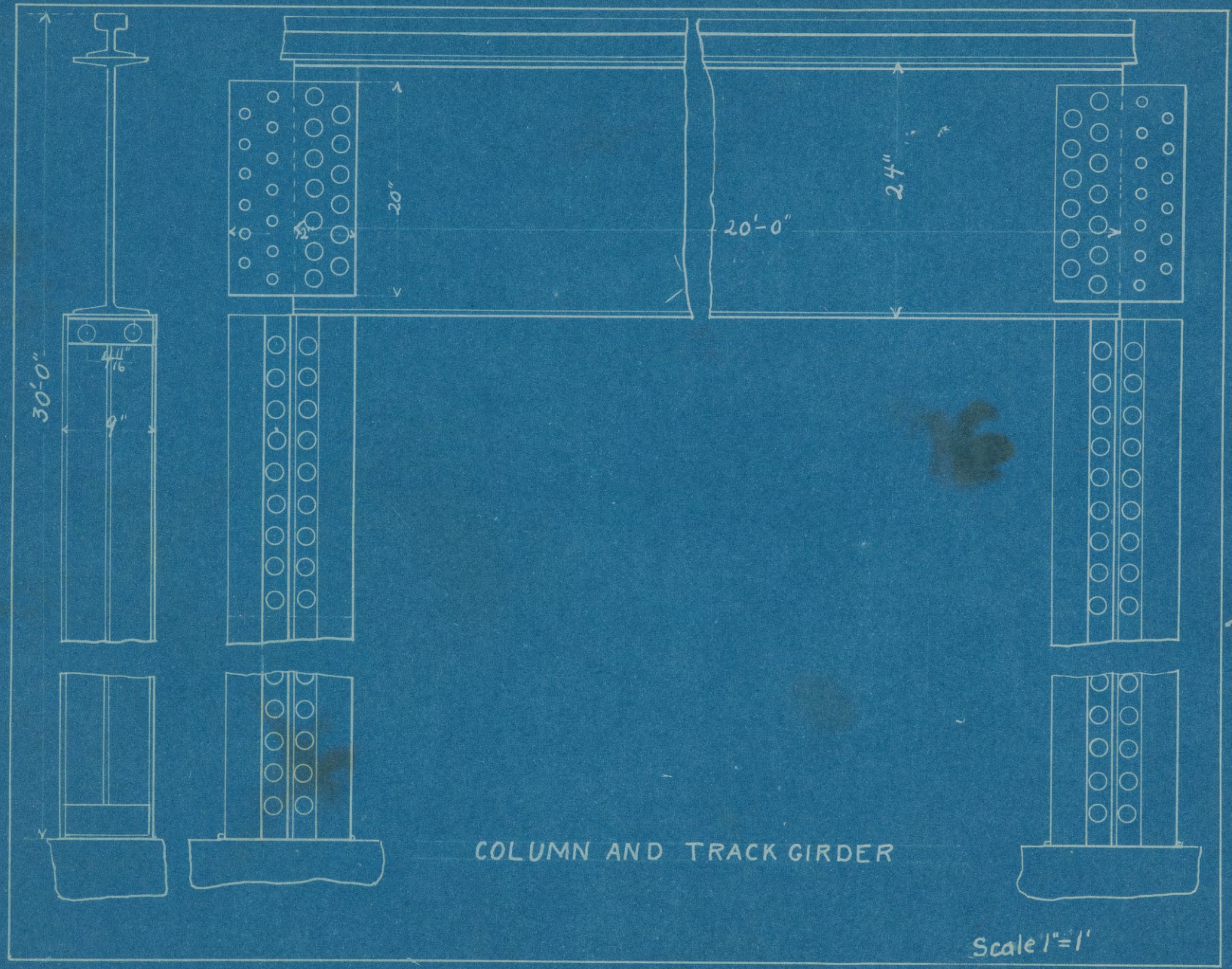
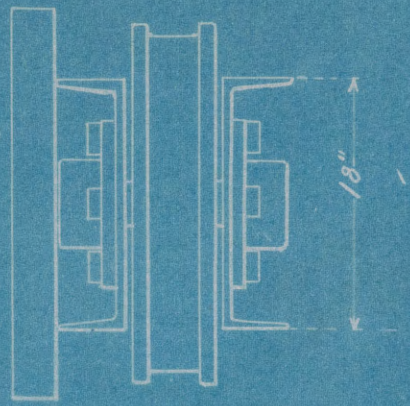

CARRIAGE BED
Scale 1"=1'

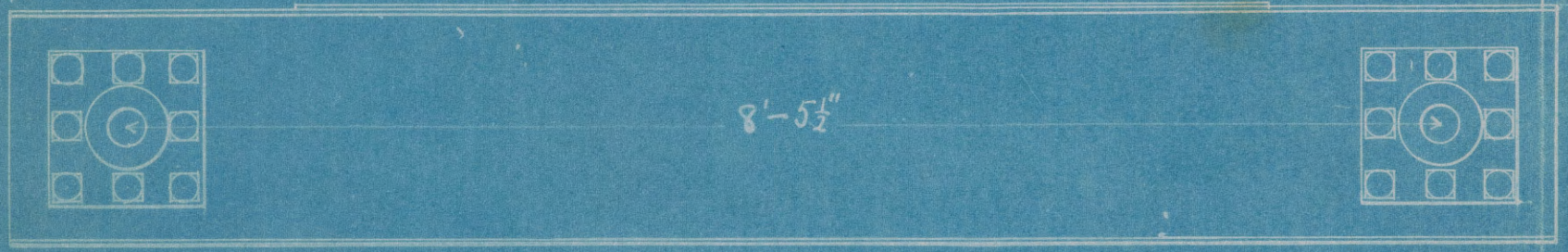


CARRIAGE BED

Scale 1"=1'

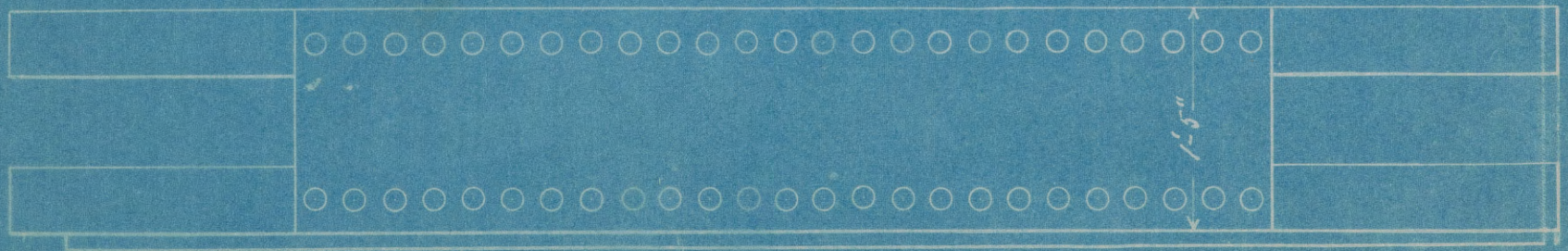

30'-0"
9"
20"
20'-0"
24"
COLUMN AND TRACK GIRDER
Scale 1"=1'

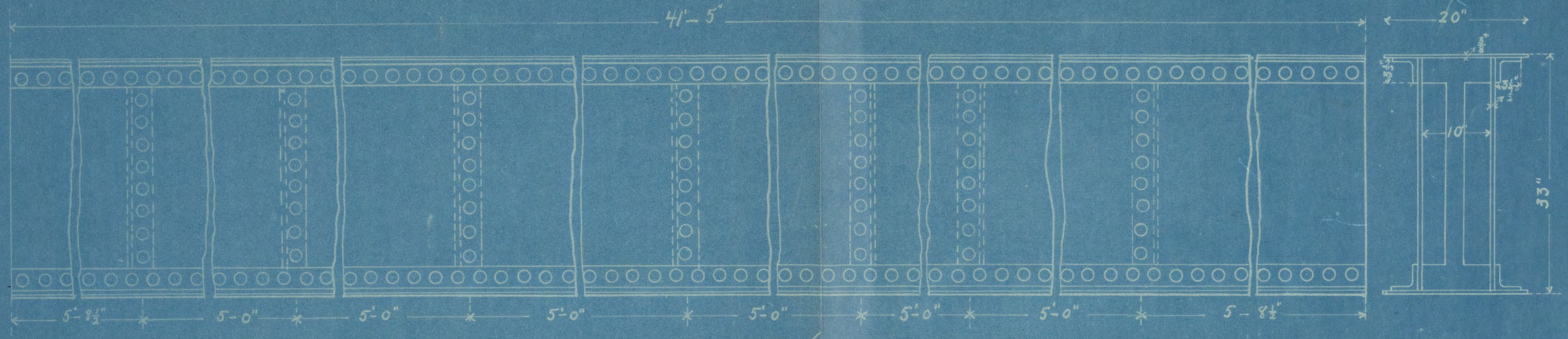




GIRDER SUPPORT

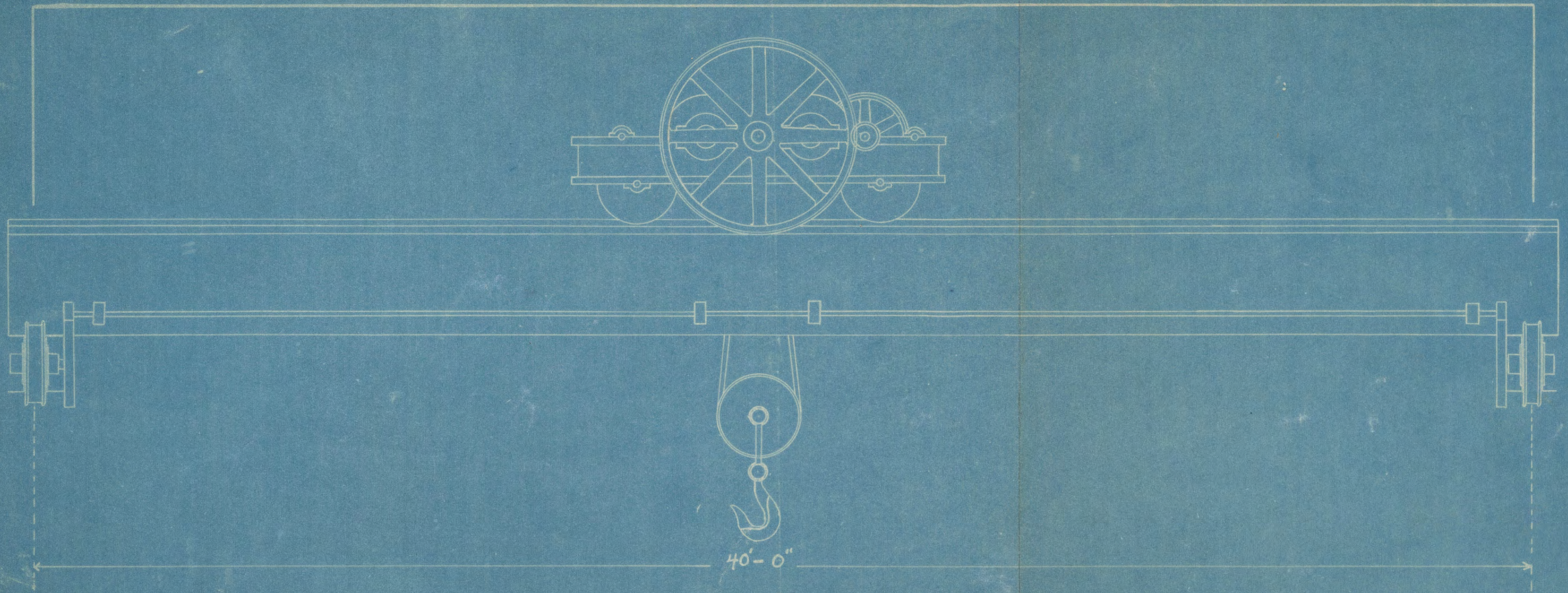
Scale 1"=1'





GIRDER

Scale 1"=1'



GENERAL VIEW

Scale $\frac{3}{8}$" = 1"