AMERICAN WESTERN RIVER STEAM BOAT ENGINE 1837

Modelled in Meccano

These steam engines are remarkable for the way they evolved independently of what was being developed in Scotland and England in the first half of the 19th century.

They were the product of trial and error methods to meet the challenge of propelling boats up and down the great rivers on the frontiers of European expansion into the west of North America.

Often beginning with the adaptation of imported factory steam engines artisans began to build engines that were lighter and more powerful to turn paddles. Artisans adhered to rule-of-thumb methods in sizing engines based on a succession of proven innovations.

Individual riverboats lasted no more than five years so there were plenty of opportunities to modify engines via new orders. In the first quarter of nineteenth century the design stabilised reaching a standard form by the 1830s. See Fig. 1.

My Meccano model depicts the main features of what became known as the Standard Western River Boat Engine (See IMG_5283b):

A long sloping engine bed positioned the heavy cylinder low in the shallow hull and the paddle shaft high to drive large paddle wheels that dipped into shallow river water. See Fig. 2.

A pin at the end of a short crankshaft engages a side paddle wheel, not modelled. See IMG_5280.

. This feature permitted the paddle wheel to be disengaged while steam was kept on the engine when the boat was moored. Two engines situated close to their respective paddle wheels became part of the standard. It also facilitated running paddlewheels in opposite directions for tight manoeuvres in rivers congested with obstacles.

The cylinder was double acting with steam cut off by a large cam centred on the paddle shaft. Next to it was the half-stroke cam used to extract more energy from steam during the stroke. (See Fig 3 below and IMG_5283) The cams were connected via long cam rods to a

system of levers and lifters that worked the steam inlet and exhaust valves situated in twin manifolds atop the cylinder. See IMG_5286.

The advantages of the Western River Steamboat Engine over the low pressure condensing engines of the Eastern Rivers were manifest. They were lighter with fewer moving parts. Maintenance was lower partly because without a condenser they could tolerate muddy river water. The near horizontal arrangement of the engine was ideal for shallow-hulled riverboats with either stern or side paddle wheels. High-pressure steam enabled quick response to varying river conditions such as propulsion against rapids, flood flows and semi-submerged trees. The simplicity of this engine led to its application in Western River boats with no significant modifications for more than seven decades.

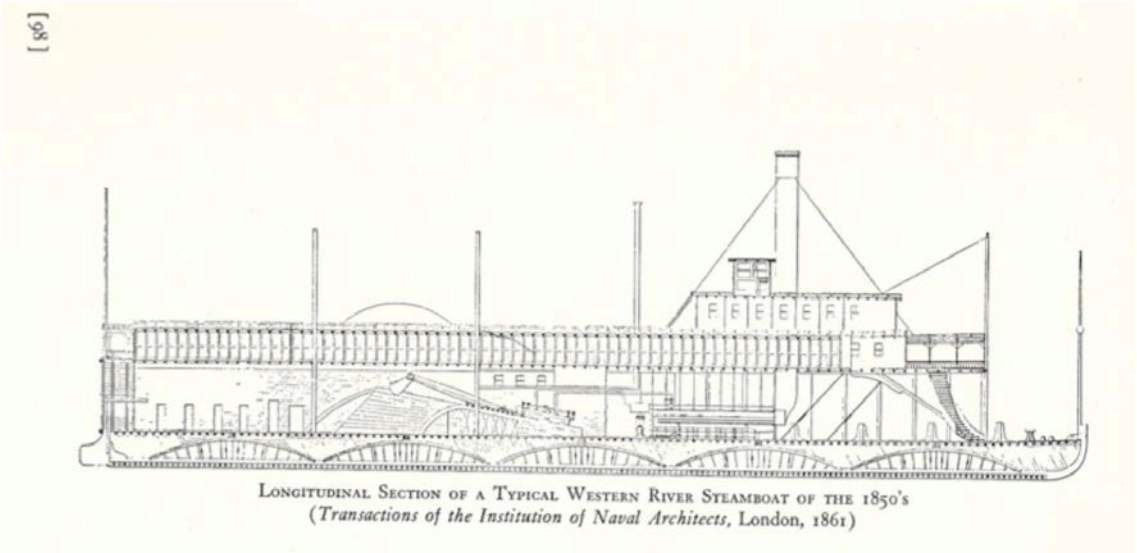
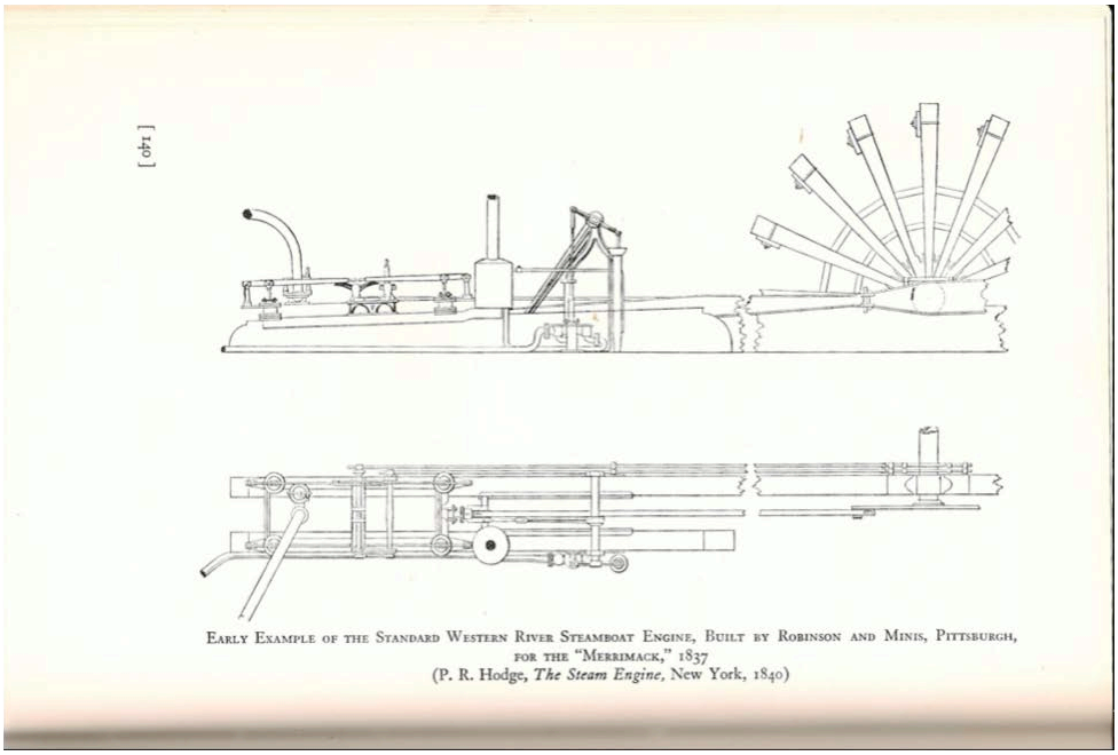


Fig 1

Western River boats featured a long, wide timber hull strengthened by tied arched frames.



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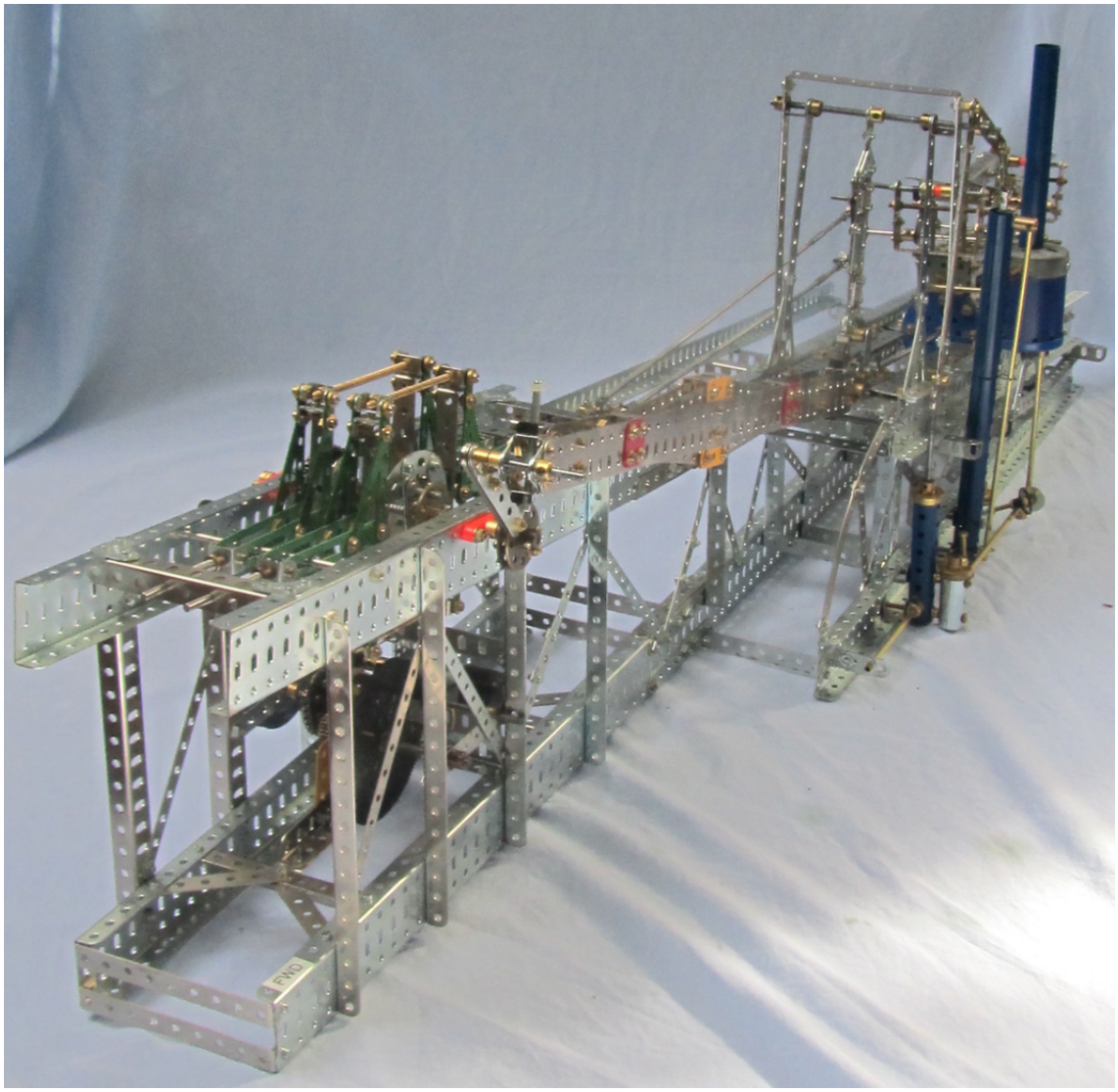
EARLY EXAMPLE OF THE STANDARD WESTERN RIVER STEAMBOAT ENGINE, BUILT BY ROBINSON AND MINIS, PITTSBURGH, FOR THE "MERRIMACK," 1837
(P. R. Hodge, *The Steam Engine*, New York, 1840)

Fig 2



IMG_5283b

A long sloping engine bed positioned the heavy cylinder low in the shallow hull and the paddle shaft high to drive large paddle wheels that dipped into shallow river water.

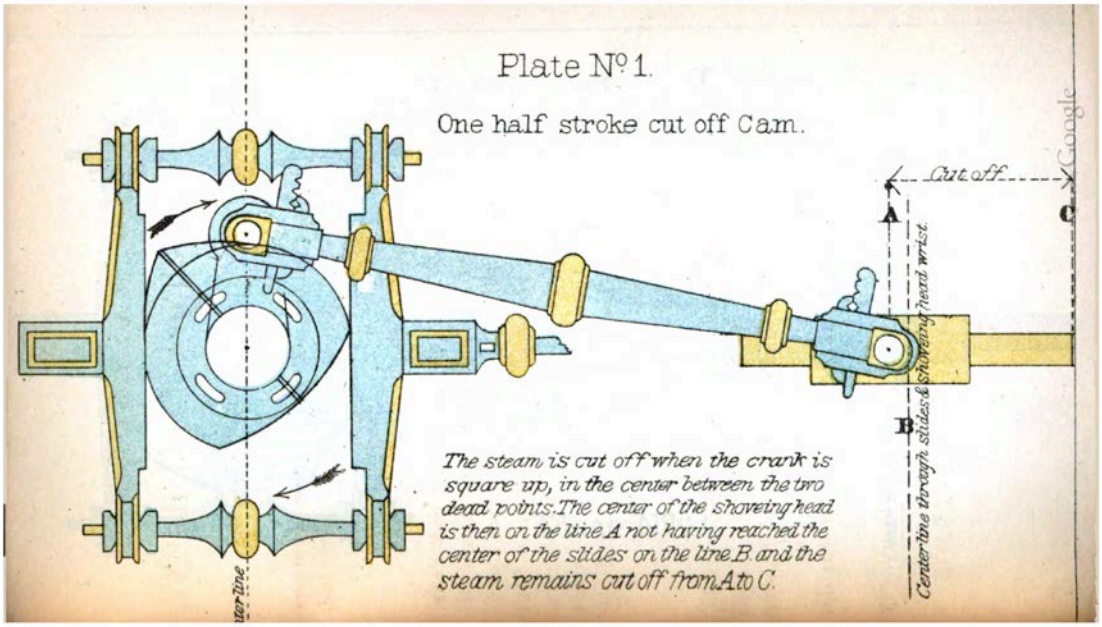
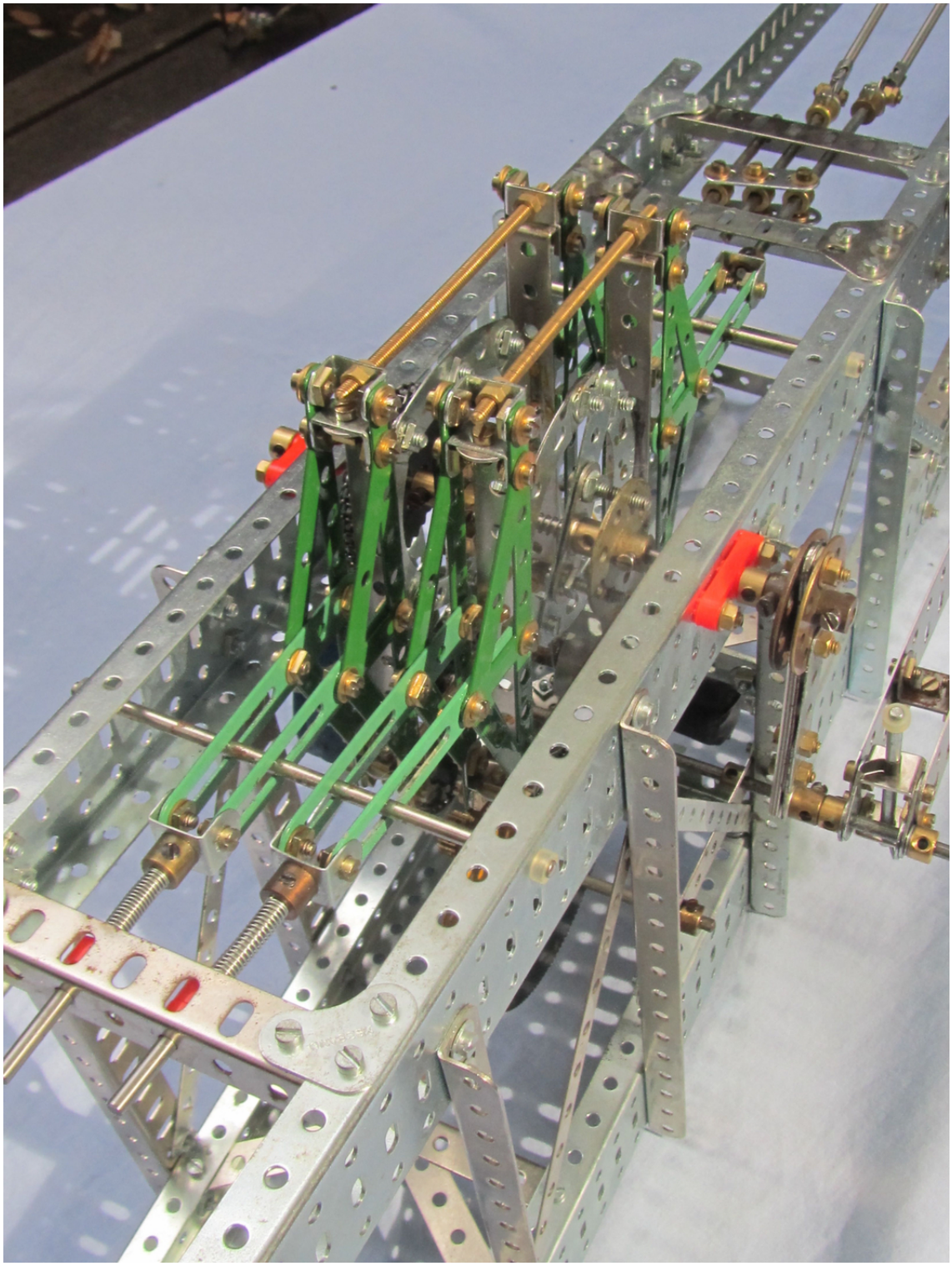


Plate Nº 1.
One half stroke cut off Cam.
Cut off.
A
C
B
Center line through slides & shoveling head wrist.
The steam is cut off when the crank is square up, in the center between the two dead points. The center of the shoveing head is then on the line A not having reached the center of the slides on the line B. and the steam remains cut off from A to C.
Google

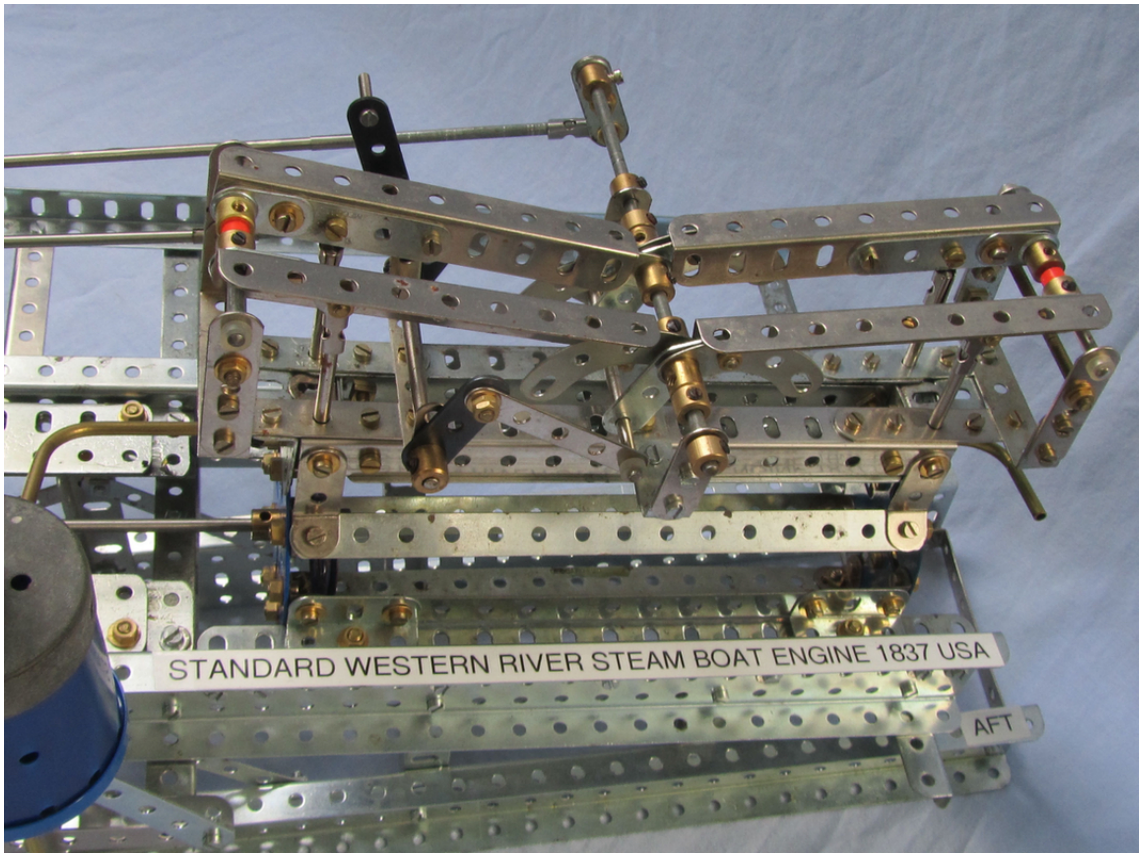
Fig. 3



IMG_5280a

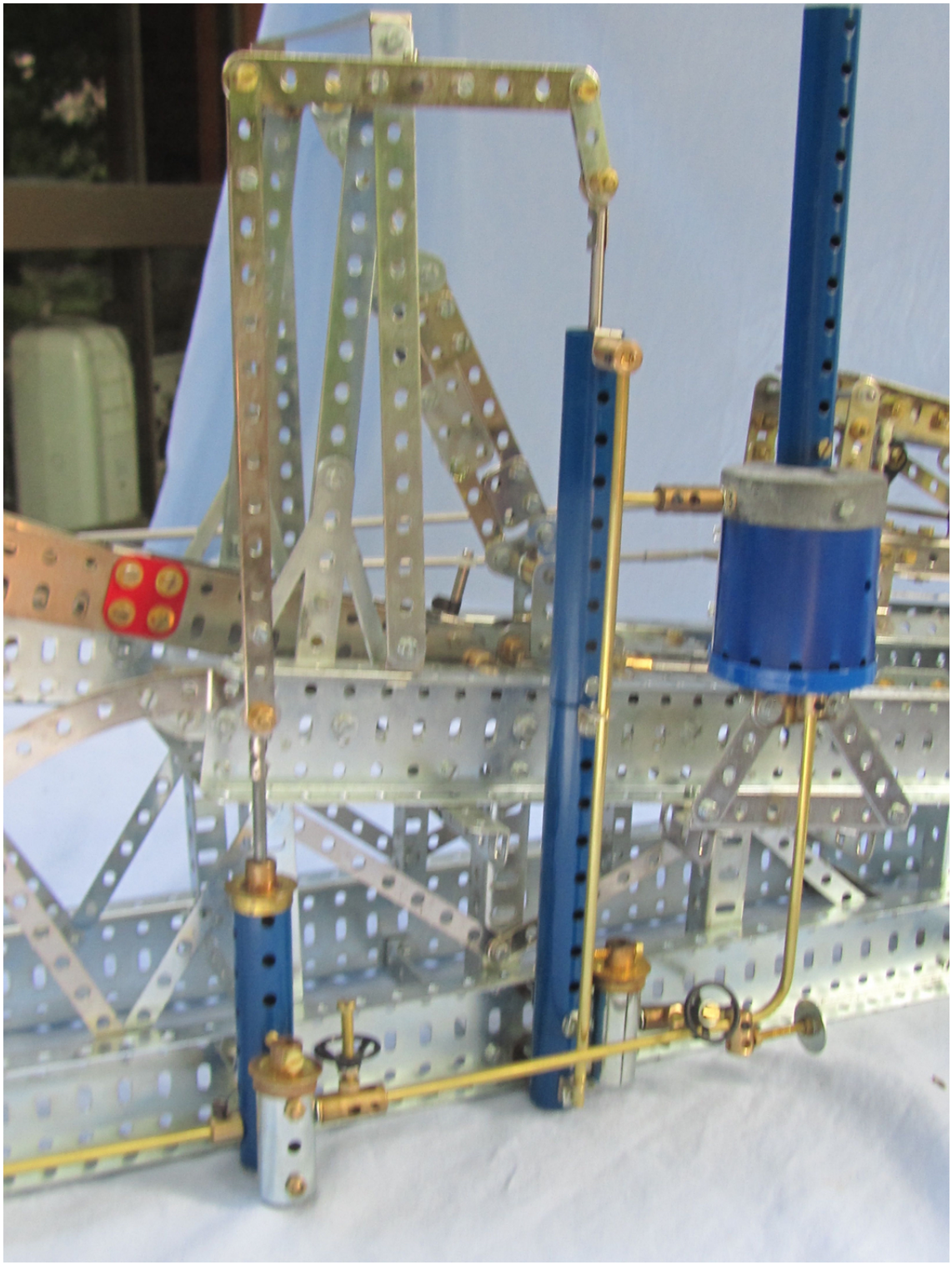
The full-stroke and half-stroke cams attached to the short paddle shaft.

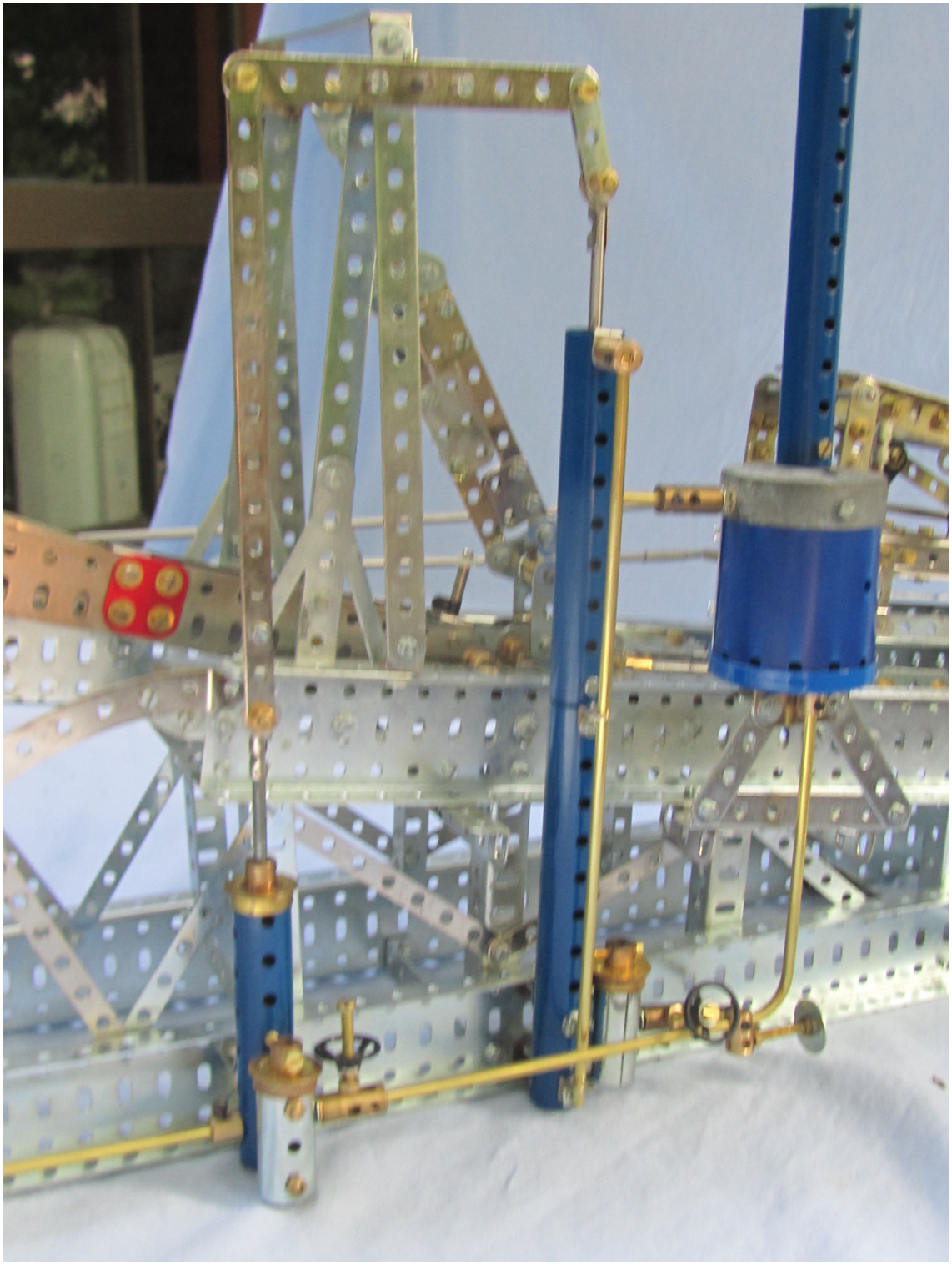
Note the pitman arm (known outside America as a connecting rod) is driven by a crank that includes an extended pin for driving a paddlewheel (not modelled).



IMG_5286a

Levers govern twin steam valves. Steam enters the low end of the cylinder. The valve gear on top regulates the steam entry and exhaust. Long cam rods work the lifters





IMG_5293a

Steam is exhausted to an expansion chamber where it is partly condensed by a water spray. Excess steam rises to the atmosphere while the boiler feed pump takes condensate, supplemented by river water. The spray pump and feed pump are driven by a sliding link to the main crosshead.