air, any decrease in which was at once made known
to those in charge of the pumps. At Fig. 6 are
seen the iron tipping-hutches used in conveying the
excavated material from the interior of the bell to the
exterior.

It will thus be seen that the chief economy in this
arrangement consisted in having the bell or caisson of
less cubic capacity than the finished work, and in being
able to remove the apparatus as each column was con-
structed. In working with the bell the excavation was
first made deep enough for a firm foundation, the build-
ing of the column was then commenced, and as it
increased in height the bell was lifted by means of the
suspension chains until the works were above water
level. The bell was then removed to the required
position of the next column, until the two piers, each
formed of two columns, were completed. The bell was
first lowered into the water on the 17th of June, 1886,
and the first column was finished in twenty-eight days.
The bell was then removed to build the second column,
but in shifting the links in one of the suspension chains
an accident occurred which caused a delay of eighteen
days. After repairing the bell, the second column was
constructed, the time occupied about it being eighteen
days, and the third and fourth columns were built
respectively in sixteen and seventeen days. The
whole of the submerged portions of the four central
columns were finished by the 11th of October, 1868
—a very satisfactory result when we remember that
eighteen days were occupied in righting the damaged
bell.

In Plate XLIX., Fig. 1 represents a general elevation
of the bridge, Fig. 2 being a plan of the central lifting
span, partly in section. Fig. 3 is a transverse section
of the lifting bridge at the bearing shaft, Fig. 4 being
a transverse section of the fixed bridge. Fig. 5 is a
sectional elevation of the lifting bridge, showing at one
end the arrangements for working the lifting machinery,
and at the other the counterbalance weight and the
chamber into which it descends when the bridge is
opened. The details of the bearings of the shaft seen
at Fig. 3, are shown at Figs. 6 and 7. An elevation,
plan, and end view of the bearing under the end of
the fixed girders are given at Figs. 8 and 9. Figs. 10 and
11 are respectively a front elevation and a plan of the
abutment pier; the piling and timber caisson used in its
construction are illustrated at Fig. 5, Plate XCVIII.
One of the columns of the central pier is shown in sec-
tional elevation at Fig. 12. Figs. 13, 14, and 15 being
respectively sections on the lines C, D, and A, B, and
a top plan of the work.

The principal parts of the bridge are the two flaps of
the central span and the four wrought-iron main girders,
The latter rest at one end on the abutment piers, and at
the other they bear on the central piers. The upper
part of each of the main girders forms the parapet of the
bridge. The main girders are connected together trans-
versely by wrought-iron cross girders, upon which the
roadway is laid. The flaps of the central span are fixed
upon axles which rest upon the central piers. Upon
each of the four columns composing the two piers is a
hollow cast-iron pedestal, surrounded by an ornamental
lamp pillar 16 ft. high. The interior of each of these
pedestals serves as a chamber for the machinery used in
opening and closing the bridge, as seen at Fig. 5, Plate
XLIX., access being obtained through a doorway in the
side. On the right-hand side of this figure is seen the
arrangement for counterbalancing the lifting bridge. By
the aid of the counterbalance weight the common cen-
tre of gravity of the flap and the arm is made to coincide
with the centre of motion. When the flap is raised,
the counterweight is carried down into a cast-iron
chamber, which is placed between the two columns of
the pier.

The four central columns are built of hewn granite
blocks laid upon a concrete foundation, which was excava-
ted to depths varying from 6 ft. to 8 ft. below the
bottom of the river bed, the masses of concrete being
from 3 ft. to 4 ft. deep, and 18 ft. in diameter. The
upper portion of the work for a distance of 8 ft. from
the top is of solid granite; the remainder, down to the
concrete, is a granite casing, filled in with brick in
Portland cement. Each of the columns is 16 ft. in
diameter. The abutment or land piers are built of brick
in cement, faced with hewn granite, the whole resting
on deep piling.

Three methods are provided for effecting the opening
and closing of the lifting bridge, namely, hand gear,
hydraulic power, and compressed air. In working the
bridge by hand, a train of toothed wheels and pinions is
set in motion by a 16 in. handle to which the power is
applied, and which is increased by the wheel gearing
432 times. To open the bridge by hydraulic power the
motion of a piston working in a hydraulic cylinder is
conveyed to the flap through a rack (see Fig. 5), which
is connected to the piston rod, and which works into a
toothed wheel fixed upon the axle or shaft of the flap.
The hydraulic power is supplied by the Copenhagen
Water Works, the pressure varying from 56 lbs. to 60 lbs.
per square inch. The water is carried through a pipe
into a slide case, from whence, by means of a slide, it
can be admitted into the cylinder on either side of the
piston.

In working the bridge by means of compressed air,
the same machinery is used as when working it by
hydraulic power, with this difference, however, that the
air is first compressed in a cast-iron reservoir by means
of two air pumps worked by hand. From the reservoir