

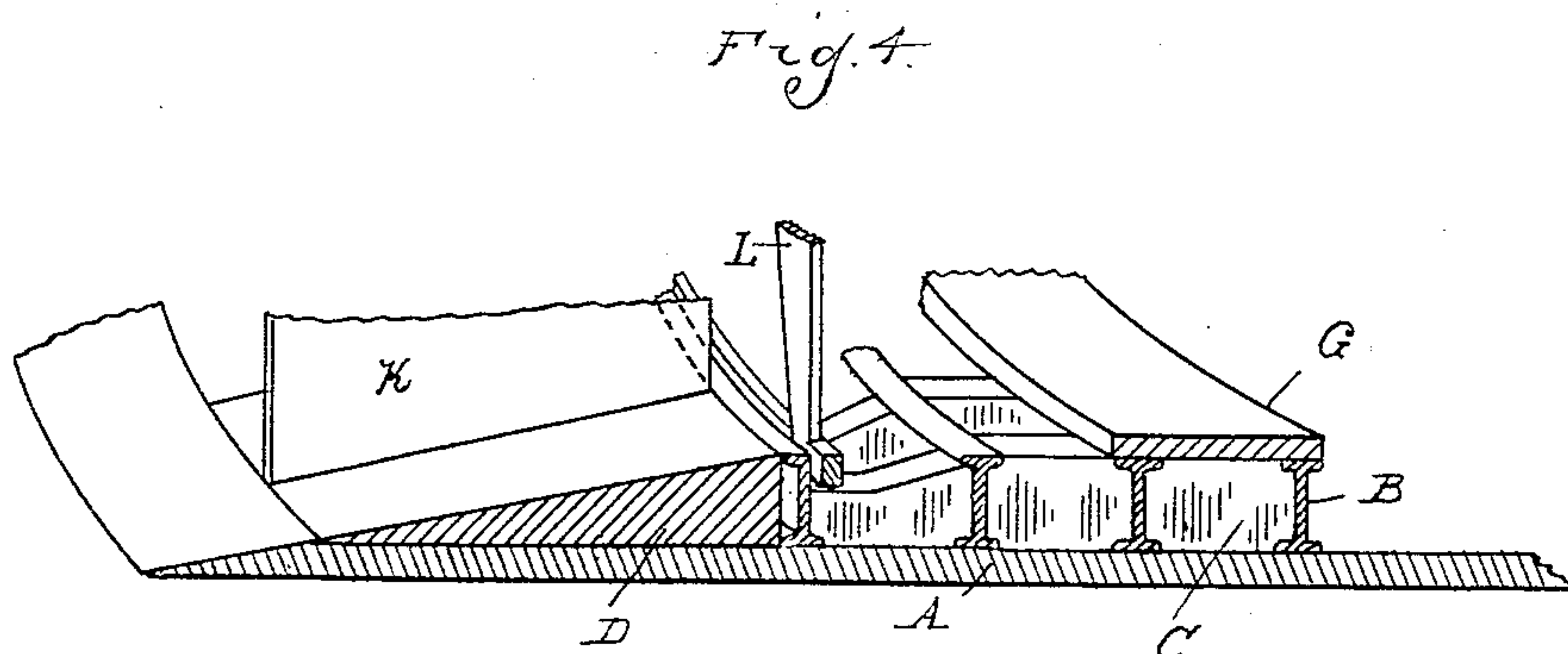
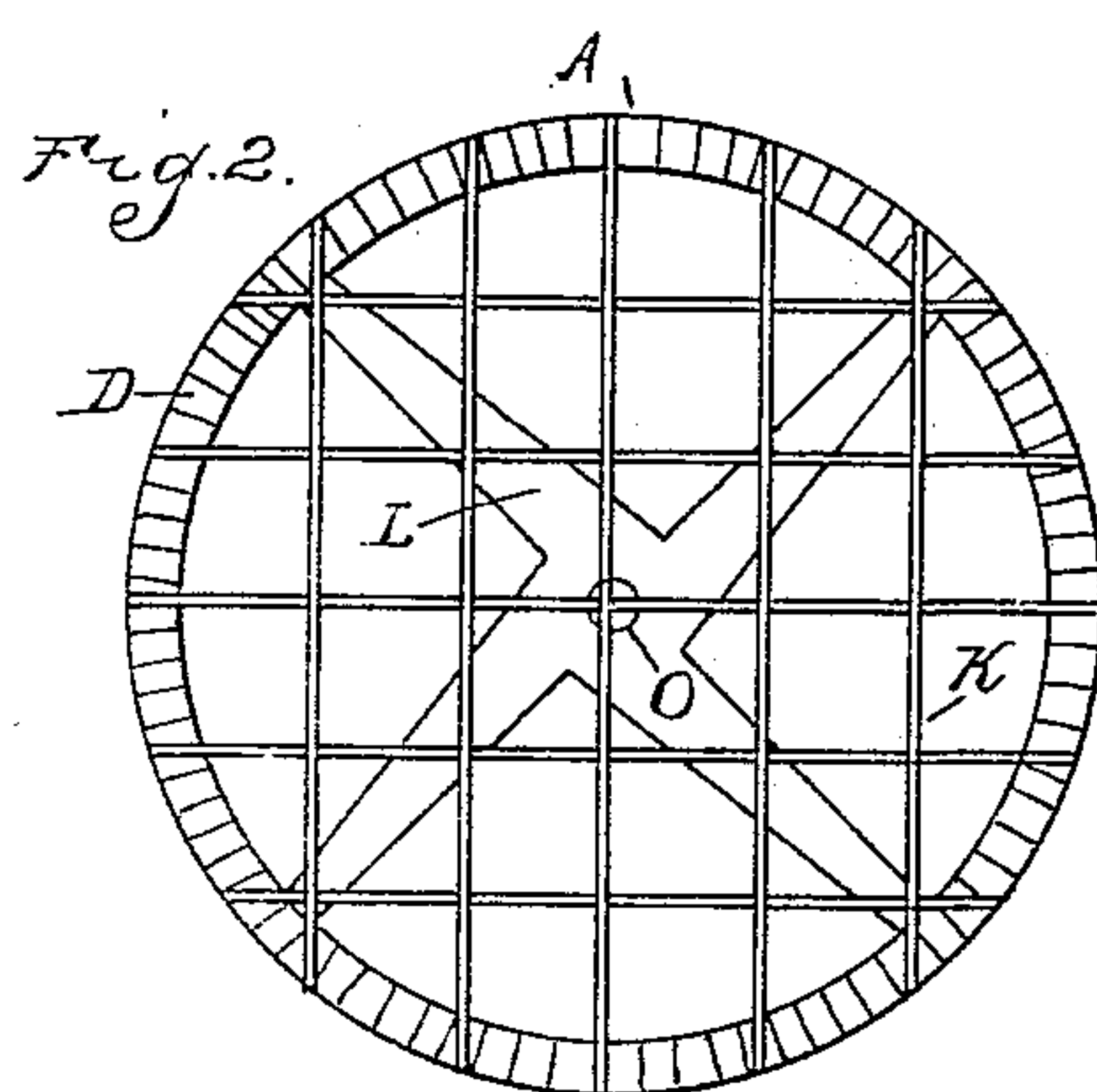
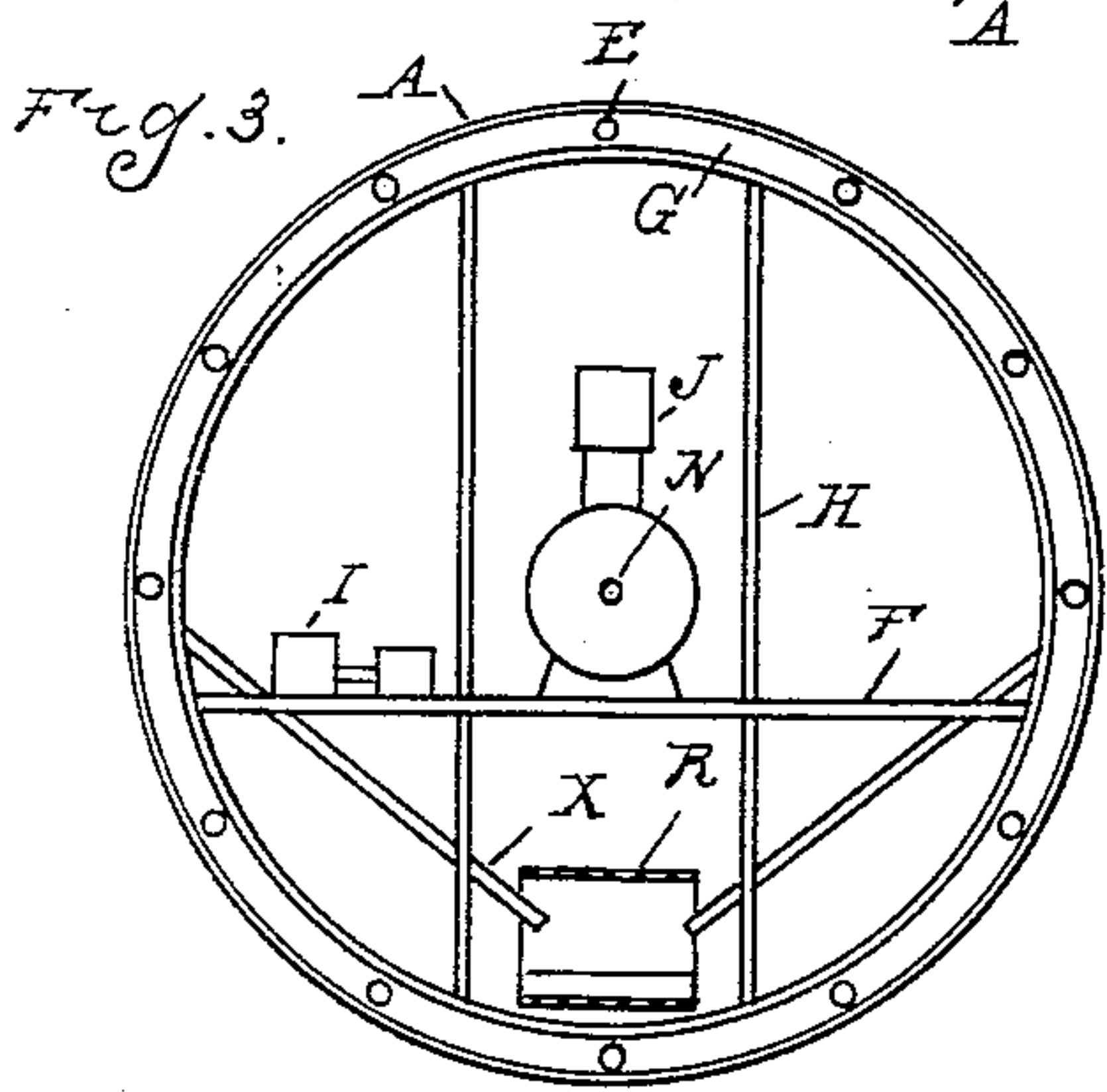
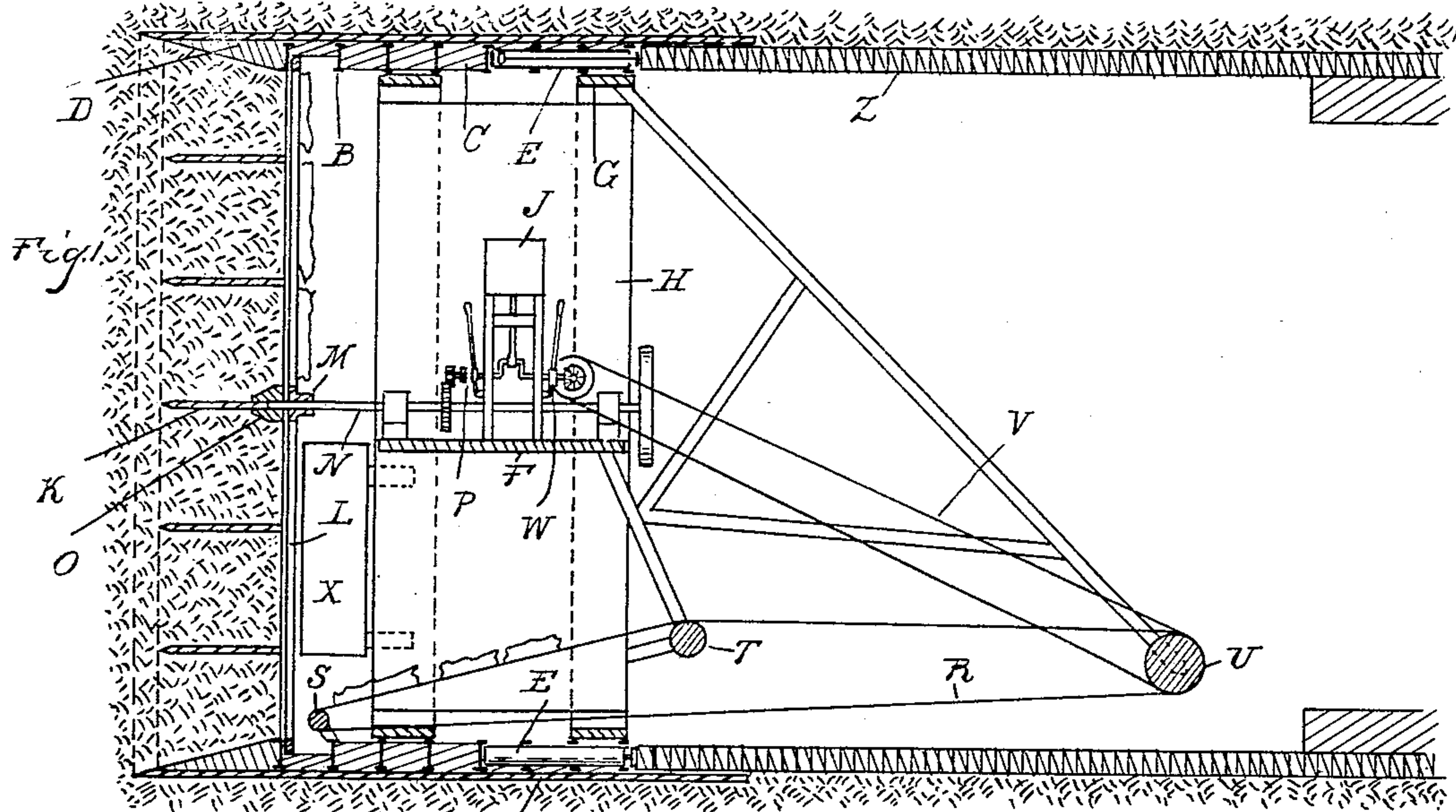
No. 745,954.

PATENTED DEC. 1, 1903.

C. H. BONNETT.
TUNNEL SHIELD.

APPLICATION FILED DEC. 11, 1902.

NO MODEL.



Witnesses
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UNITED STATES PATENT OFFICE.

CHARLES H. BONNETT, OF PORT HURON, MICHIGAN.

TUNNEL-SHIELD.

SPECIFICATION forming part of Letters Patent No. 745,954, dated December 1, 1903.

Application filed December 11, 1902. Serial No. 134,789. (No model.)

To all whom it may concern:

Be it known that I, CHARLES H. BONNETT, a citizen of the United States, residing at Port Huron, in the county of St. Clair and State of Michigan, have invented certain new and useful Improvements in Tunnel-Shields, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention relates to improvements in shields intended for use in the construction of tunnels.

It is the object of the invention to provide a structure in which the work of excavating is greatly facilitated.

It is a further object to provide a rotatably-adjustable platform within the shield, which is adapted to support the machinery used in connection with the excavation and for the forcing of the shield forward, said platform being adapted to be adjusted to maintain its horizontal position.

A further object is to provide means for cutting the earth excavated into small sections and also to provide means for expeditiously removing it to the rear.

Still further, the invention consists in the peculiar construction, arrangement, and combination of parts, as more fully hereinafter described, and shown in the drawings, in which—

Figure 1 is a vertical longitudinal section through my improved shield, showing the same as in use in the formation of a tunnel. Fig. 2 is a front elevation thereof. Fig. 3 is a rear elevation, and Fig. 4 is a sectional perspective view, of a portion of the shield.

A is an outer casing, preferably of cylindrical form. This casing is strengthened against lateral pressure by a series of circumferential ribs B, preferably of I-beams or other structural shapes. These ribs are suitably spaced from each other and are longitudinally braced by intermediate blocks C. In the inner forward portion of the casing the ribs B are omitted and tapering blocks D are employed, which extend from the first of said ribs to near the outer edge of the casing.

For forcing the shield forward it is provided with the usual hydraulic jacks E, which are arranged in circumferential series therearound and are preferably located in

apertures formed in a portion of the rib B. In the rear of these jacks is a portion of the casing A, which is of a length substantially equal to the movement of said jacks, and thus serves as a protection when the shield is forced forward.

Within that portion of the shield in which the circumferential ribs are located is arranged a rotary platform F. This platform is secured to rings G, which bear upon the inner faces of the ribs B, and the platform is also intermediately supported by vertical members H. The rings G are of a size to loosely fit within the ribs B, so that the platform F may be at any time rotatably adjusted in relation to the casing A. The object of this adjustment is that in the operation of pressing the shield forward there is frequently a twisting movement thereto, so that if the platform F were permanently secured to the shield it would be turned from its horizontal position. With the construction described whenever any twisting of the shield occurs the platform may be readily readjusted to the horizontal position. Upon this platform is arranged the hydraulic pump I, which is used for operating the jacks, and also a motor J for operating the automatic cutters and carriers, which will now be described.

In the forward portion of the shield is arranged a series of cross-plates K, which divide the open area into a series of small squares. These plates preferably extend continuously in a vertical direction between opposite edges of the shield, while the laterally-extending divisions are formed by short plates arranged intermediate said vertical plates and secured thereto in any suitable manner. The forward edges of the plates K are sharpened and form knives for cutting the earth into sections during the forward movement of the shield. The plates are held against movement by the resistance of the earth by abutting against the circumferential rib B. Directly in rear of these plates is arranged a rotary cutter L, and this comprises a plurality of knives secured to a common rotary head M, the latter being secured to a shaft N, arranged in the line of the axis of the shield and journaled at its forward end in a bearing O, secured to the plates K. The rear end of the shaft N is connected, through

a suitable intermediate gearing, with motor J, said gearing preferably including a clutch P, by which the shaft may be connected or disconnected from the motor. With the arrangement just described whenever the shield is forced forward a rotary motion may be simultaneously imparted to the cutter L from the motor J, which will cause the cutting off of the earth forced into the path of said cutter between the plates K. Inasmuch as these plates K first sever the earth into small sections, it is obvious that the operation of the cutter L will divide the earth into comparatively small pieces, which may be readily conveyed to the rear and carried out through the tunnel.

To facilitate the carrying away of the earth there is arranged an automatic carrier R, which consists of an endless belt. At its forward end this belt passes around a roll S, which is arranged a short distance above the bottom of the shield. From this point the belt extends in an inclined direction, passing over an intermediate roll T and thence horizontally and around a rear roll U, after which it returns to the roll S. The rolls T and U are supported by suitable braces or a framework connected to and extending rearwardly from the rings G. This frame may be connected directly to the ribs of the shield from carrier R. The carrier is driven by suitable intermediate gearing and sprocket-wheel and chain V. This intermediate gearing is also provided with a controlling-clutch W. The width of the carrier is only a fraction of the diameter of the shield, and to direct the cut earth thereon inclined deflector-plates X are arranged on opposite sides of said carrier in front of the platform and extending to the walls of the casing.

The construction being substantially as shown and described, in operation the shield is forced forward through the medium of the jacks E and the pistons F, which bear against the temporary structural work Z, with which the tunnel is first lined. As the shield is pressed forward the earth is forced through the plates K, which divide it into small sections, and is then cut into thin cakes by the rotary knives L. As soon as severed these cakes are dropped onto the deflector-plates X, from which they will be directed upon the carrier R. The latter is in constant operation during the cutting of the earth and will convey the severed cakes rearward to a point

where they may be loaded into the cars for conveying the earth out from the tunnel.

I desire to call special attention to the means employed for dividing the earth into small sections and also to the arrangement of the rotatably-adjustable platform by which the machinery may always be held in upright position regardless of any twisting in the outer shield.

What I claim as my invention is—

1. In a tunnel-shield, the combination with the outer shell or casing and means for forcing the same forward, of a series of blades extending across the open area at the forward end of said shield and rigidly secured to the latter whereby in the forward movement of the shield the earth is divided into sections.

2. In a tunnel-shield, the combination with the outer shield or casing and means for forcing the same forward, of a series of blades extending across the open area, and a rotary cutter in rear of said blades, whereby the forward movement of said shield will first sever the earth in sections and then cut said sections in separate cakes.

3. In a tunnel-shield, the combination with the outer casing and means for forcing the same forward, of a series of blades extending across the open area at the forward end of said casing, a rotary cutter in rear of said blades, and a carrier extending from said cutter rearward in said casing.

4. In a tunnel-shield, the combination with the outer shell or casing and means for forcing the same forward, of a platform rotatively supported within said shell and adapted to be adjusted to compensate for any twisting of said shell in its forward movement.

5. A tunnel-shield comprising an outer shell or casing, a series of circumferential ribs within said shell and intermediate spacing-blocks extending longitudinally thereof.

6. A tunnel-shield comprising an outer casing or shell, a series of circumferential ribs within said shell, longitudinally-extending spacing-blocks intermediate said ribs, and tapering blocks extending from the forward rib to the cutting edge of the shell.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES H. BONNETT.

Witnesses:

M. B. O'DOHERTY,
A. G. ROBERTSON.