

(No Model.)

2 Sheets—Sheet 1.

J. APPLEBY.  
DRIVING CHAIN.

No. 562,364.

Patented June 23, 1896.

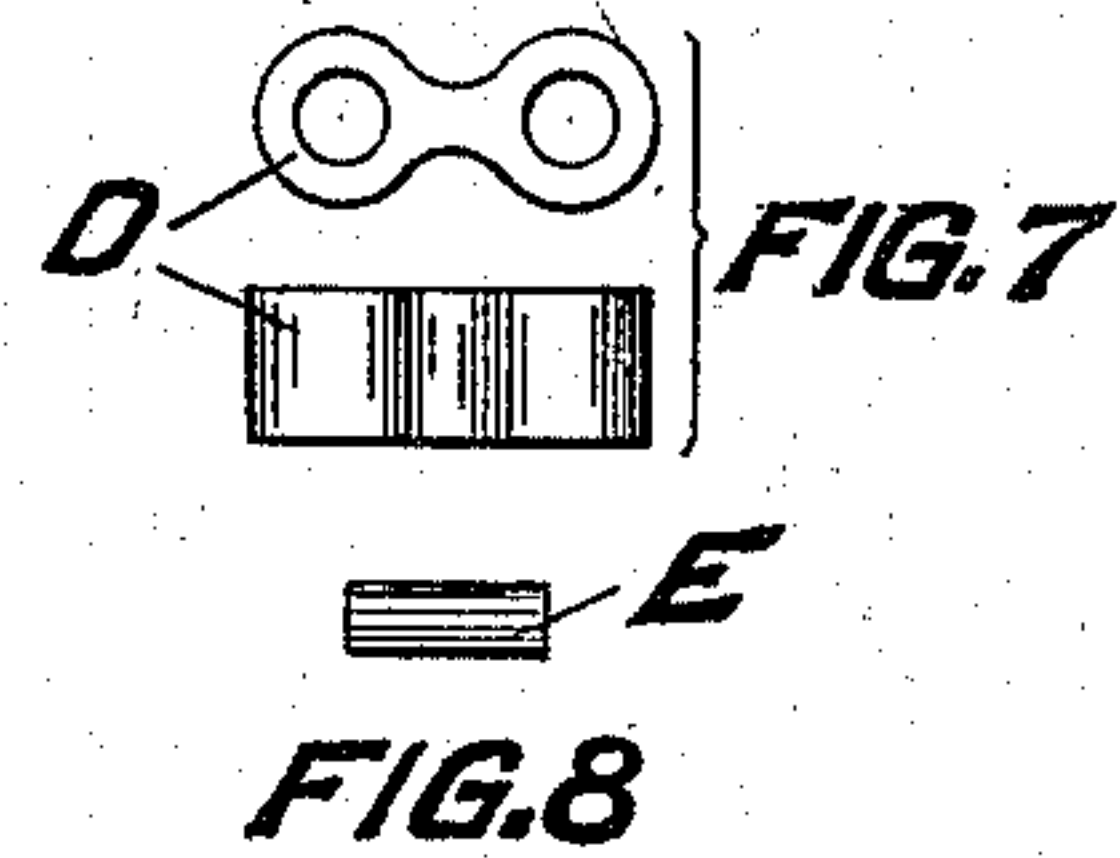
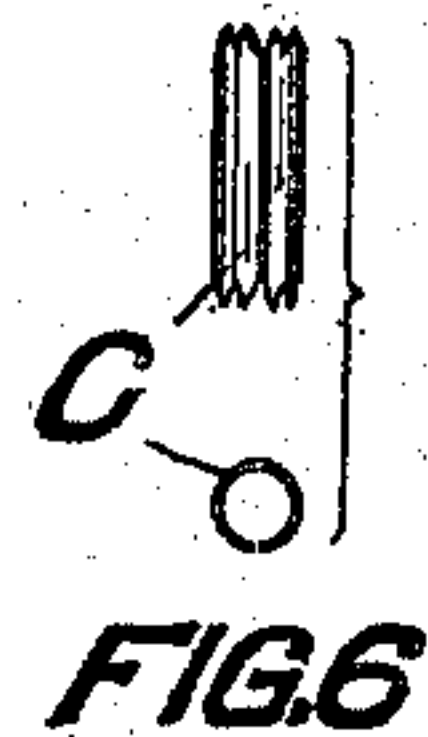
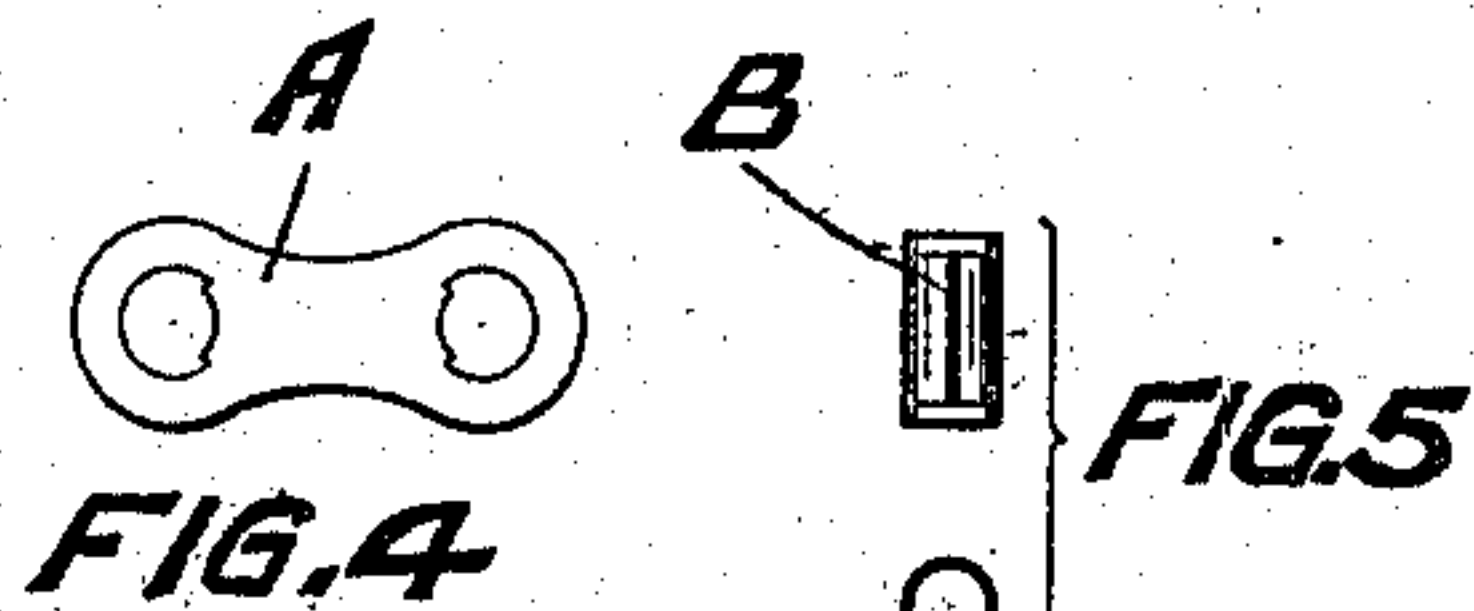
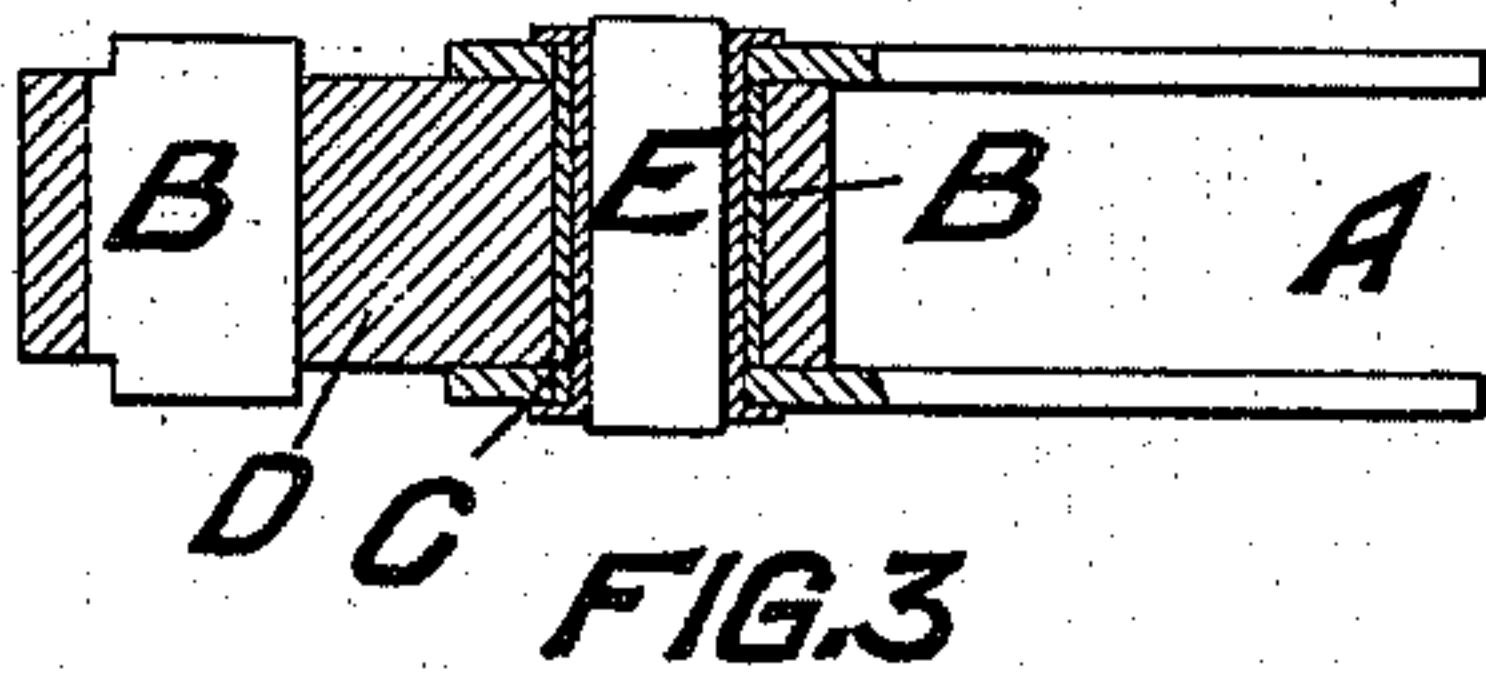
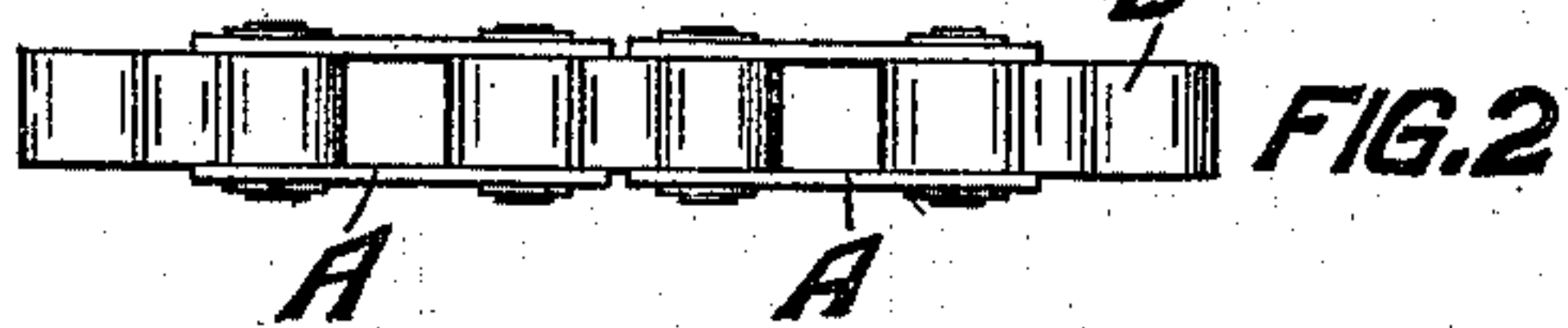
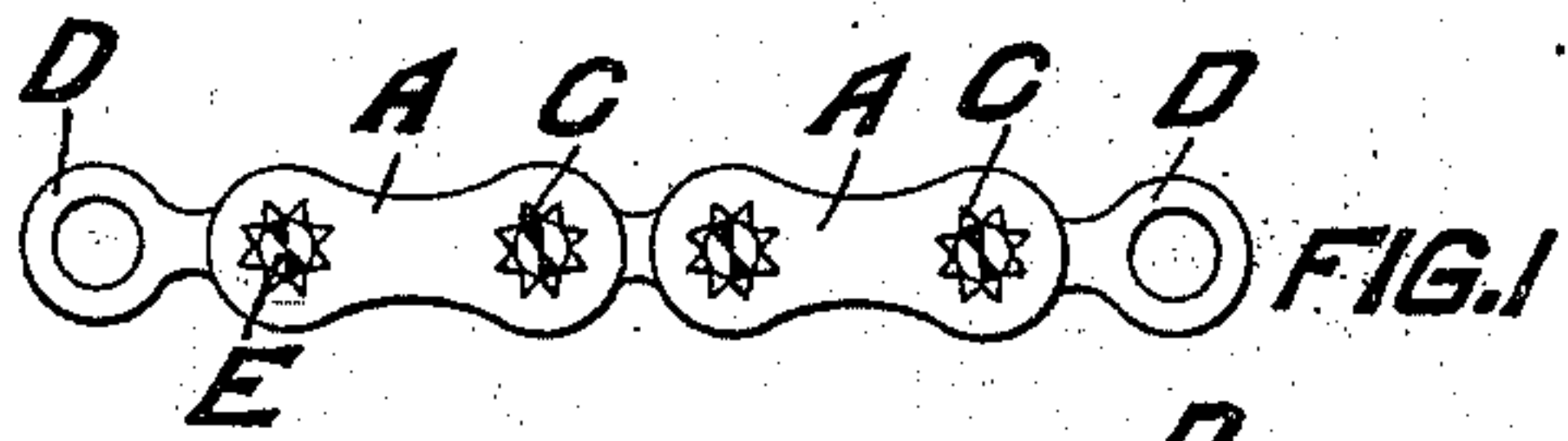
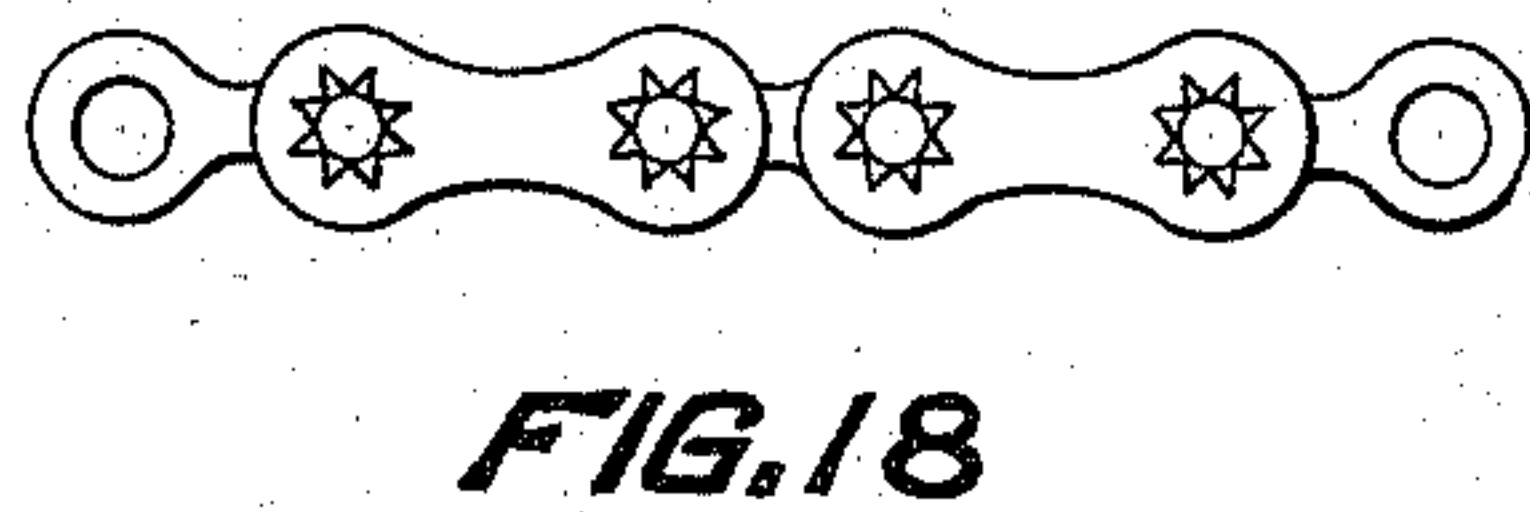
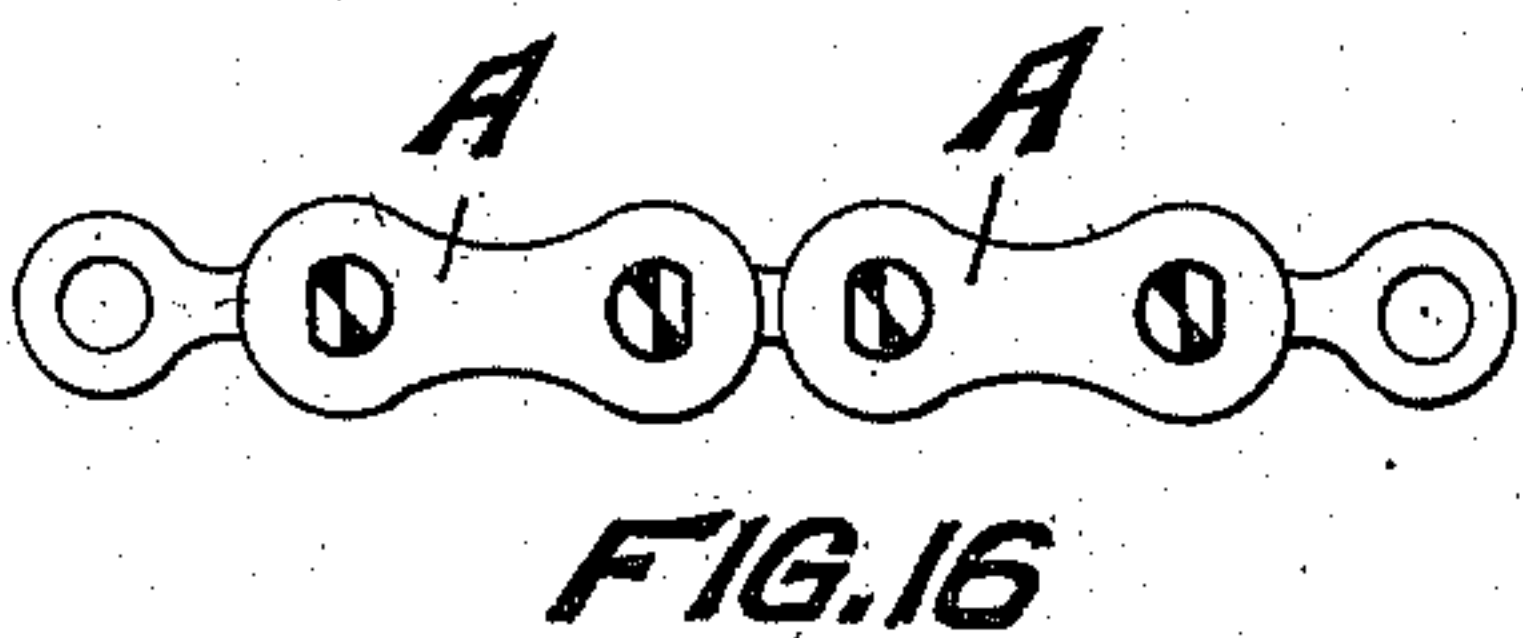
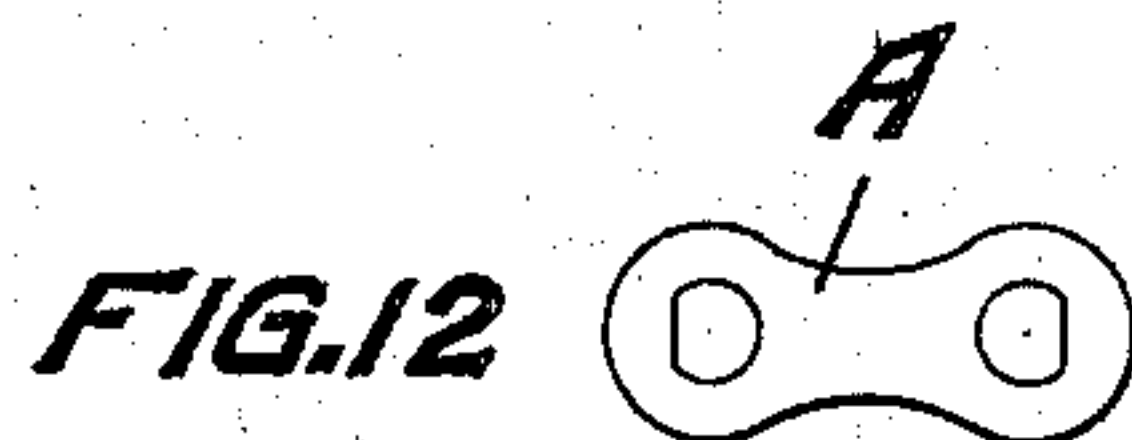
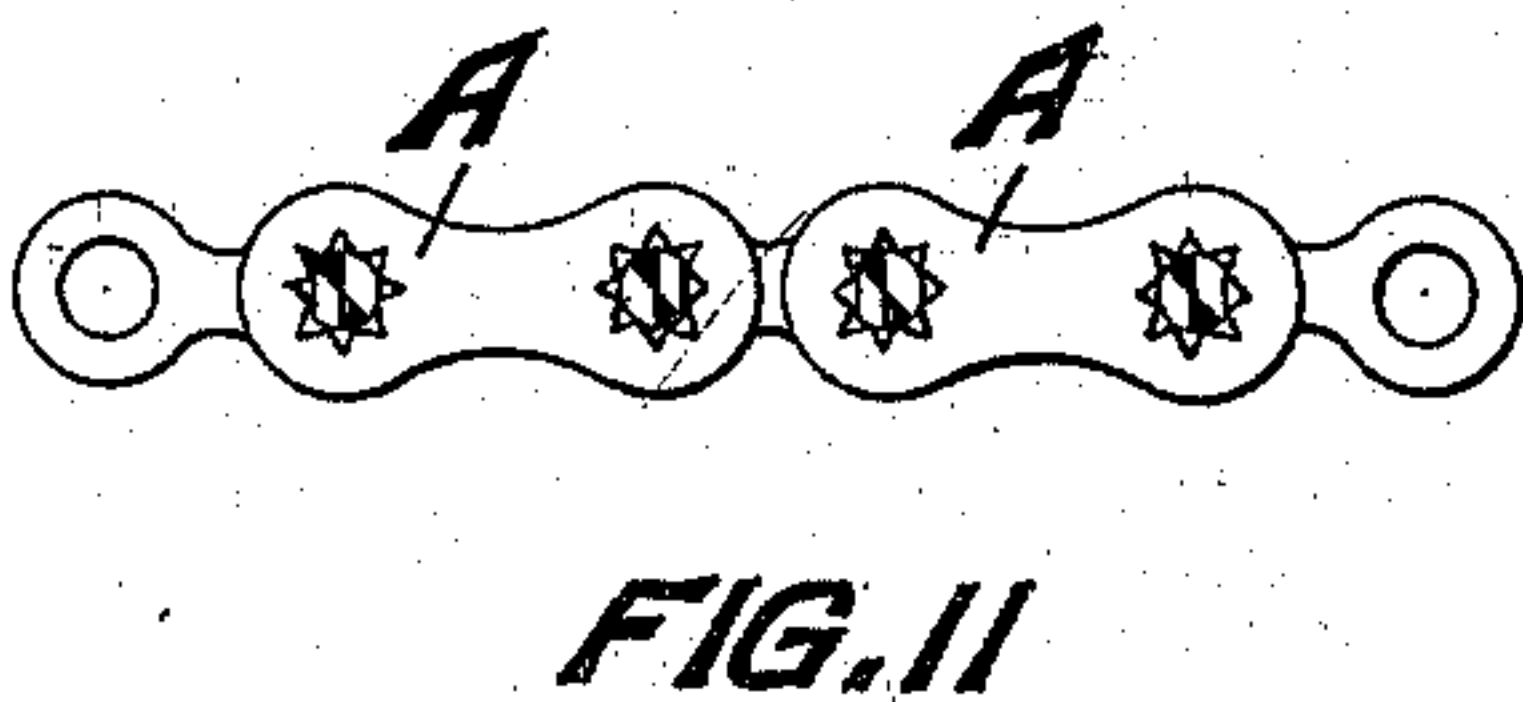
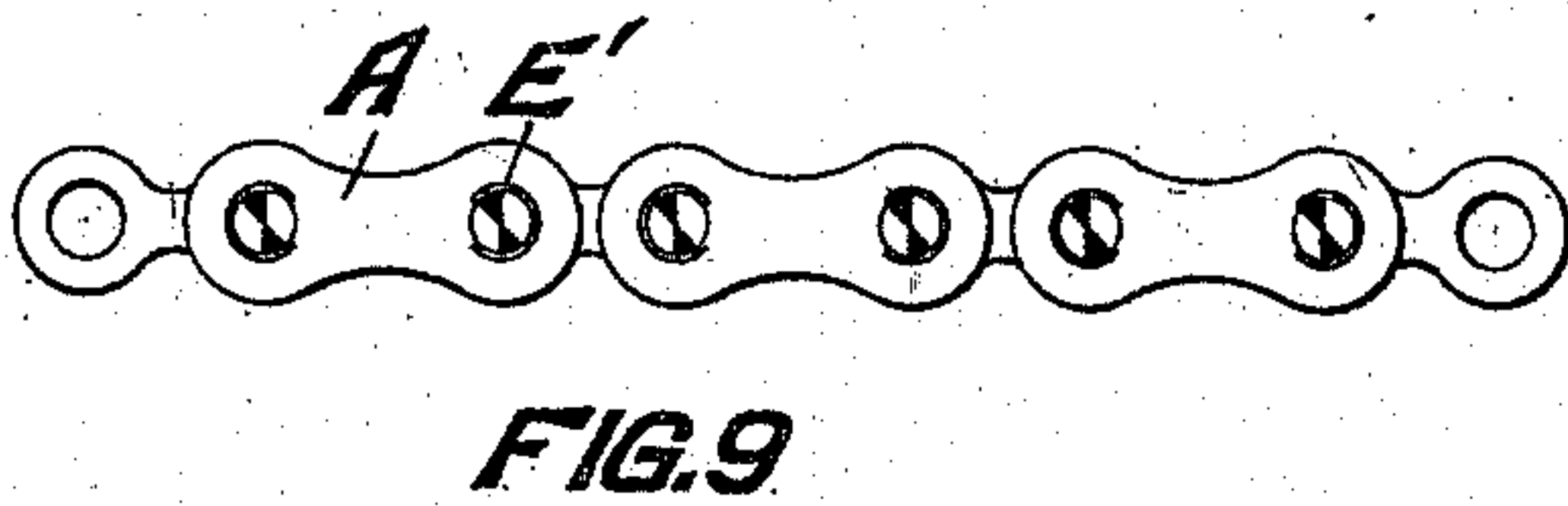


FIG. 8



Witnesses  
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(No Model.)

2 Sheets—Sheet 2.

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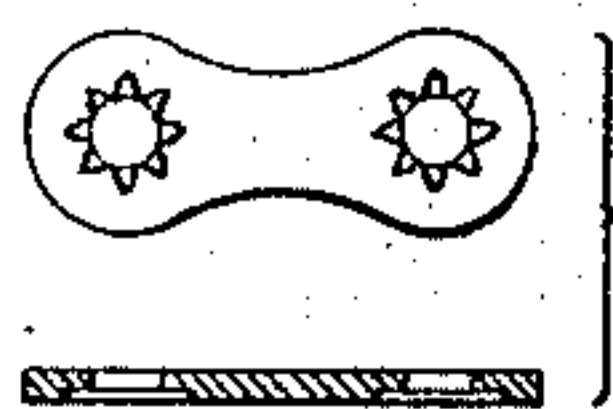


FIG. 19

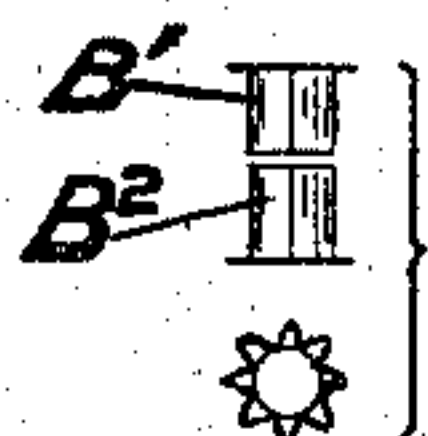


FIG. 20



FIG. 21



FIG. 22

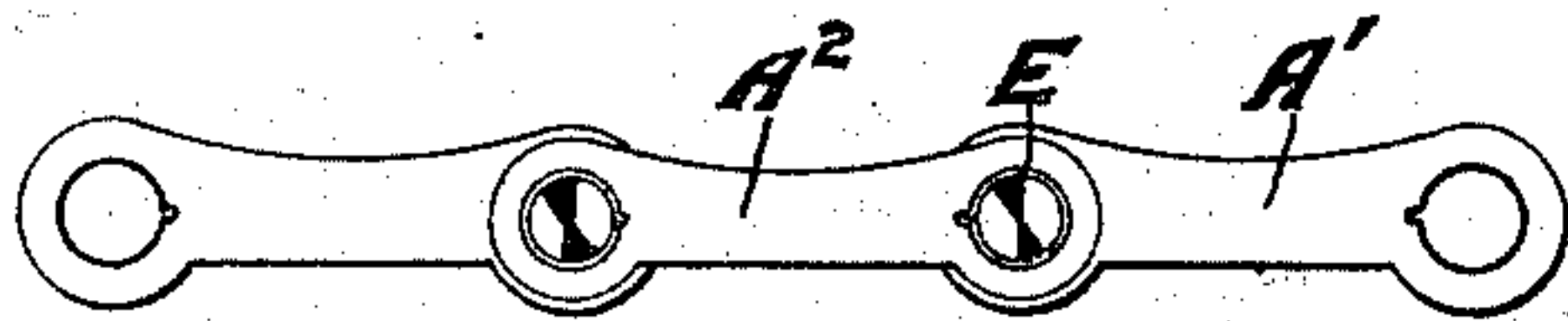


FIG. 23



FIG. 25



FIG. 24

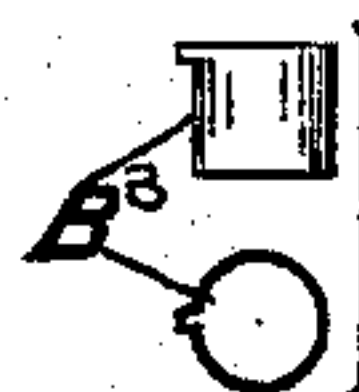


FIG. 26

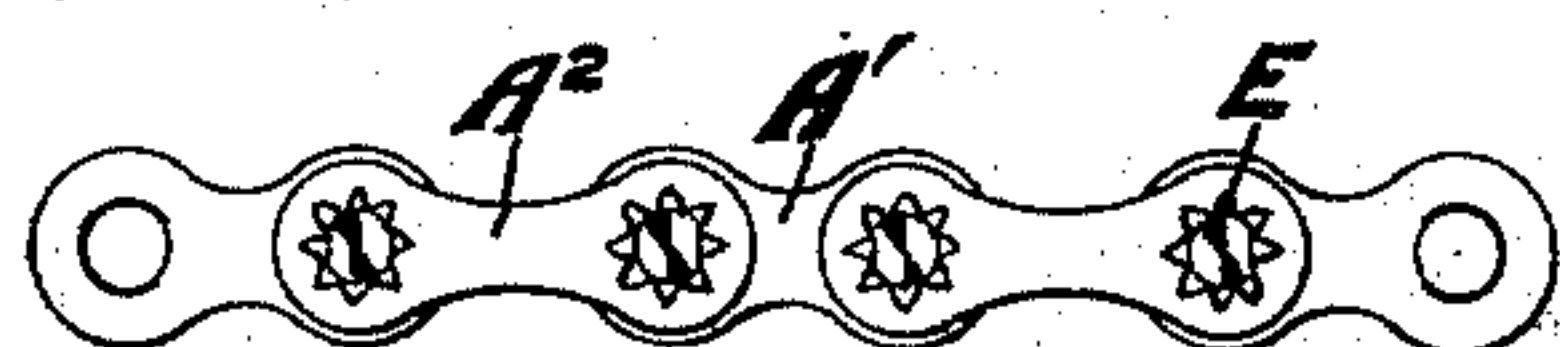


FIG. 27

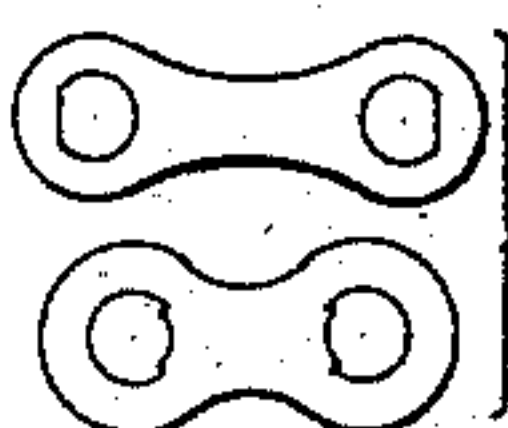


FIG. 29



FIG. 31



FIG. 28



FIG. 30



FIG. 32

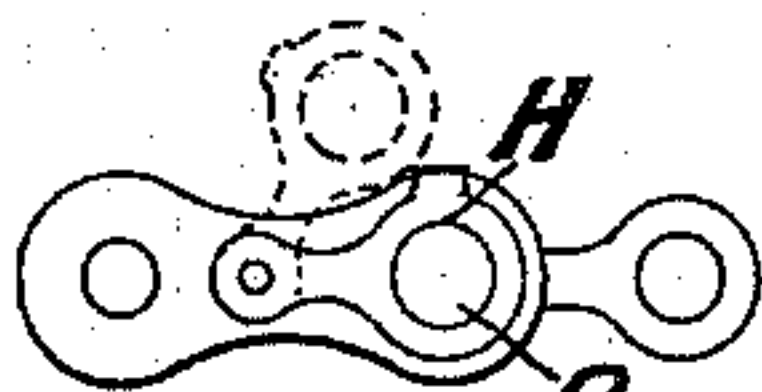


FIG. 33

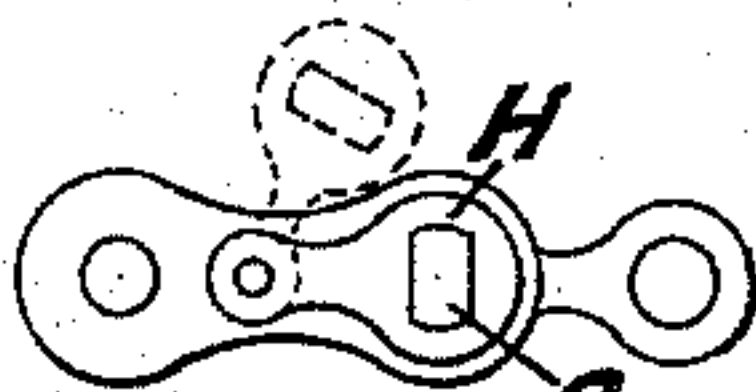


FIG. 34

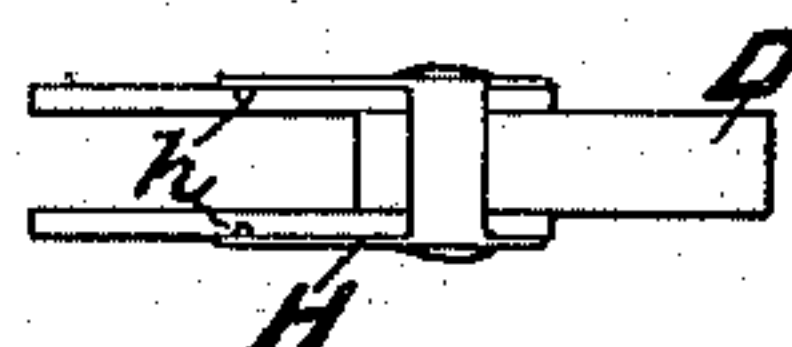
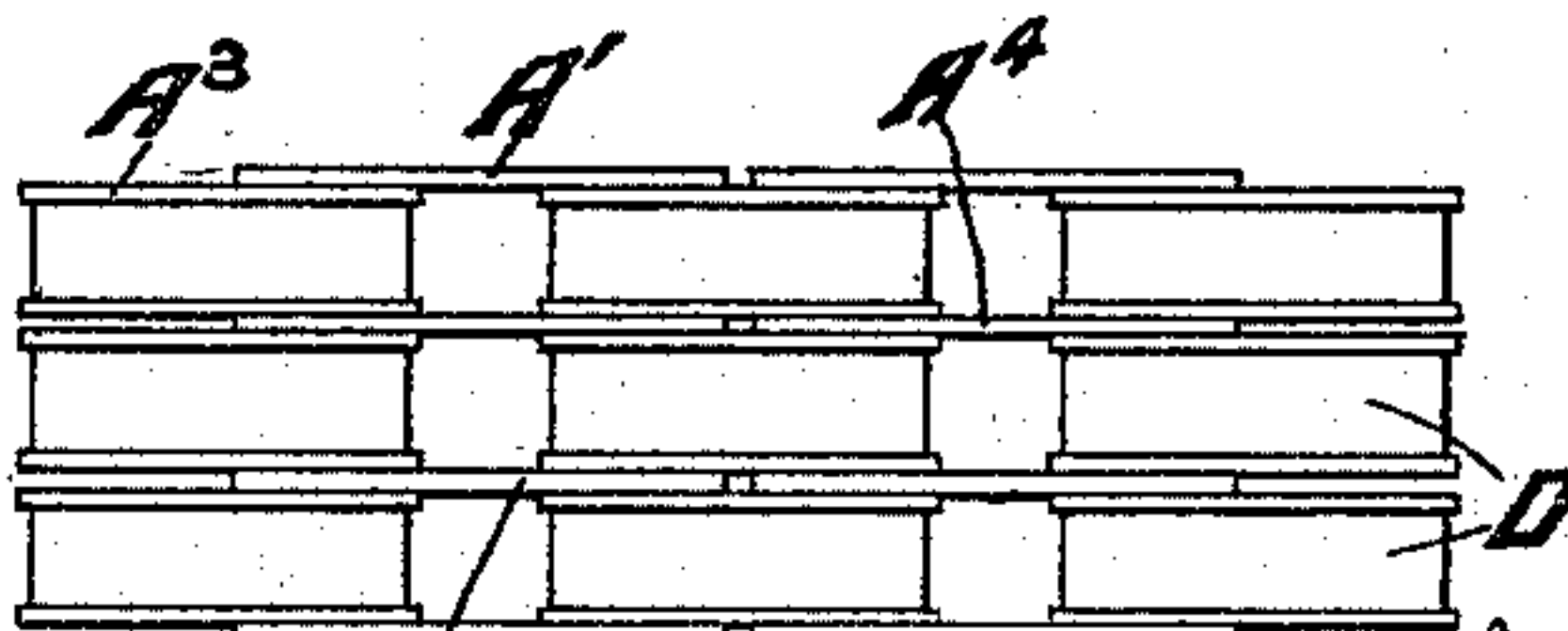
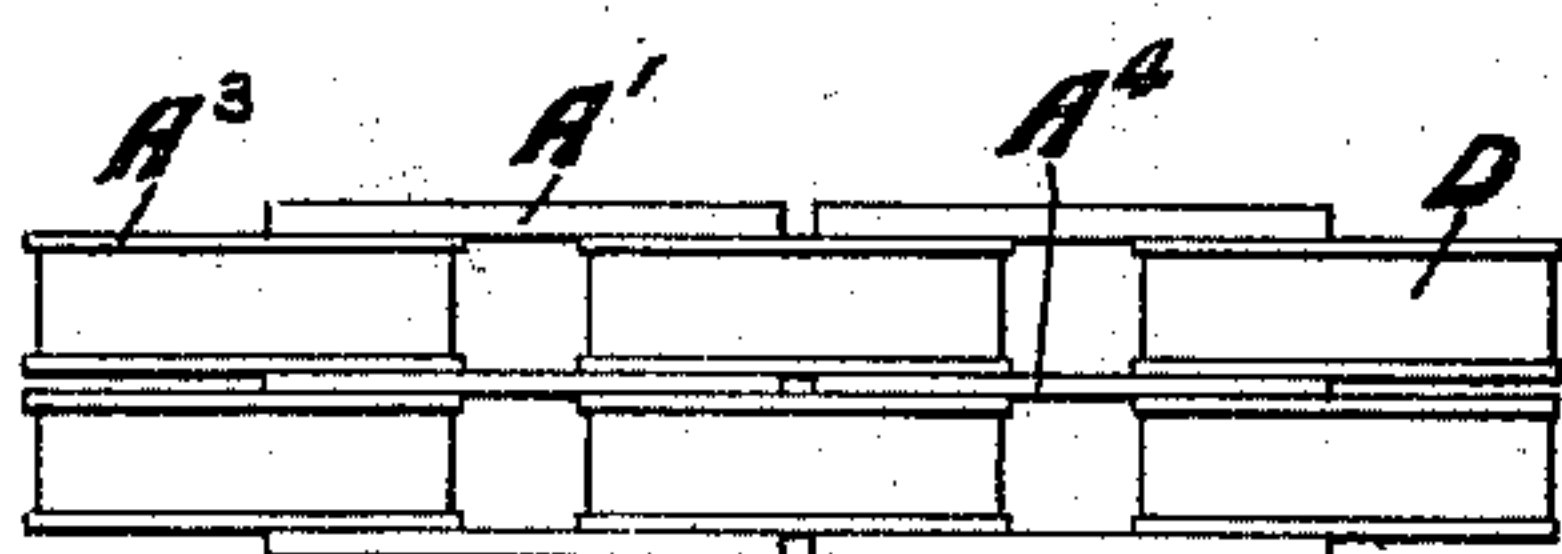


FIG. 35



FIG. 36



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# UNITED STATES PATENT OFFICE.

JOSEPH APPLEBY, OF ASTON, ENGLAND.

## DRIVING-CHAIN.

SPECIFICATION forming part of Letters Patent No. 562,364, dated June 23, 1896.

Application filed January 11, 1896. Serial No. 575,163. (No model.)

*To all whom it may concern:*

Be it known that I, JOSEPH APPLEBY, a citizen of Great Britain, residing at Castle Cycle Chain Works, Tower Road, Aston, in the county of Warwick, England, have invented certain new and useful Improvements in Driving-Chains, of which the following is a specification.

This invention relates to improvements in driving-chains for use upon cycles and other machines, my object being to construct a light and durable chain having its component parts very securely connected together without rivets, such as are ordinarily employed for this purpose, and to provide simple means for readily coupling the terminal links to form a complete endless chain.

In order that my invention may be the more readily understood, I append hereunto two sheets of explanatory drawings, to be hereinafter referred to.

On Sheet 1, Figure 1 is a side elevation, and Fig. 2 a plan, representing links of an ordinary pattern cycle-chain constructed in accordance with my invention. Fig. 3 is an enlarged plan, partly in section, illustrating the method of connecting together the component parts of the chain, such parts being shown separately by Figs. 4 to 8, inclusive. Fig. 9 is a side elevation of the chain having a modified form of joint or pivot connection, the central pin for such connection being shown at Fig. 10. Fig. 11 is a side elevation of a chain having D-shaped connecting-pins and bushes, the side plates, bushes, and pins of such chain being represented in detail by Figs. 12 to 15, inclusive. Fig. 16 is a side elevation of a chain with pivot connections similar to those employed in the chain illustrated at Fig. 11, but without the employment of the intermediate tube or bush. Fig. 17 shows the connecting-pin employed at each of such joints. Fig. 18 is a side elevation illustrating a chain in which the connection is made without a solid central pin. On Sheet 2, Fig. 19 represents the side plates, and Fig. 20 the bushes, for a chain with joints or pivot connections, such as illustrated by the part-sectional plans, Figs. 21 and 22. Fig. 23 is a side elevation, and Fig. 24 a plan with part in section, representing a roller-chain with the joints or pivot connections formed with a

solid pin passing through side plates of the form shown at Fig. 25, and bushes or tubes, such as illustrated at Fig. 26. Fig. 27 is a side elevation, and Fig. 28 a plan with part in section, illustrating a roller-chain having a modified form of joint or pivot connection. Fig. 29 gives an elevation or side view of the side plates of such chain, while the split or open-jointed tubes are shown by Figs. 30 to 32, inclusive. Figs. 33 and 34 illustrate the means of coupling the terminal links to form the complete endless chain. Fig. 35 is a plan of a chain with double blocks or bearing-pieces, and Fig. 36 a similar view of a chain with treble blocks or bearing-pieces arranged parallel with each other.

The same reference-letters in the different views indicate the same parts.

Referring to Sheet 1, Figs. 1 to 8, I produce the steel side plates A in the ordinary manner, with holes at each end of a form, such as shown at Fig. 4, for the purpose of preventing rotation or movement of the hardened-steel bush B, the ends of which are notched or shaped, as shown in the elevation of the bush at Fig. 5, to correspond with the holes in the plate A. Each link of the chain consists of two side plates A, connected together in the first instance by the hardened-steel tubes or bushes B, fitting within and between them, as illustrated at Fig. 3. Through each hard-steel bush B, I pass a soft-steel tube C, which is of such length as to project slightly beyond the external surface of each side plate. The ends or projecting portions of the tube C are serrated, as shown by the elevation or side view at the upper part of Fig. 6, and such ends are flanged or turned over and pressed against the outer sides of the plates, as illustrated at Fig. 1.

To build up the chain, I use double-ended connecting-blocks, such as D, each block having two holes, as illustrated in the detail view, Fig. 7, and I place the blocks between the side plates A, each hole having within it a hard-steel tube or bush B. I then pass through the hard tube the soft tube C and flange over the projecting ends. The side plates are thus held together, and the hard-steel tubes or bushes B serve as distance-pieces to insure that the plates shall be accurately spaced apart to allow the connecting-blocks D to act



freely within or between them. To give additional strength to the joints or pivot connections, I drive through the inner or soft-steel tube C a pin E, hardened or tempered in oil or in any other convenient manner, and which is of such length that its ends come flush with the outer surfaces of the side plates A. Each of the tubes B and C is split or open-jointed, and thus on driving in the pin D the ends of both tubes are expanded tightly within the holes through the side plates A.

I sometimes dispense with the intermediate or soft tube C, and expand the ends of the tube B within the side-plate holes by driving in a pin E', such as shown at Fig. 10, having such diameter as to cause it to fit tightly within the tube. Three links of a chain jointed in such a manner are shown at Fig. 9.

The holes through the side plates A may be formed to a D shape, as shown at Fig. 12, the hard-steel tube B, the inner or soft tube C, and the pin E being then also formed to a like D shape, as shown from Figs. 12 to 15, inclusive. Two links of a chain having such a form of joint or pivot connection are shown at Fig. 11. A D-shaped hard-steel tube and a similarly-shaped pin are employed for the joints of the chain illustrated at Fig. 16; but in this case the soft or inner tube is dispensed with, the central pin (which is illustrated in detail at Fig. 17) being driven into the hard tube, whose ends are thus expanded tightly in the side plates.

When a very light chain is required, I dispense with the solid central pin D and form the joint with the hard-steel tube, such as B, with the soft inner tube C having its projecting ends flanged over on to the side plates, as hereinbefore described. Two links of a chain with such a form of joint or pivot connection are illustrated at Fig. 18.

Referring to Sheet 2, Figs. 19 to 22, inclusive, illustrate a modification of my method of forming the joints or pivot connections without the use of the soft inner tube C, hereinbefore referred to. The hard-steel tube is formed in two parts B' and B<sup>2</sup>, Fig. 20, each part having a flange and preferably with serrated edges, as illustrated. The outer side of each plate is recessed, as shown by the views given at Fig. 19, to receive the end flanges of the tubes B' and B<sup>2</sup>. When placed in position in the side plates, I cause the two parts B' and B<sup>2</sup> to butt against each other, and I then drive a solid central pin through the whole, as illustrated at Fig. 21, and thus expand the ends of the tube rigidly within the side plates. The frictional hold or grip of the tubes upon the solid pin prevents any lateral displacement of the side plates.

Instead of forming the hard tube in two parts, as shown at Fig. 20, each part having a flanged end, I sometimes employ a single tube, preferably of a D shape, equal in length to the width of the chain, and expand the same within the holes of the side plates by means of two pins, each provided with a head

or flange, which I drive in from opposite sides and cause to meet at the center, as shown at Fig. 22.

In the construction of a roller-chain such as illustrated by Figs. 23 to 26, inclusive, the inner side plates A' are secured together by the hard-steel open-jointed tube or bush B<sup>3</sup>, Fig. 26, fitting tightly within the side-plate holes, and which has a teat or projecting piece at one end fitting within a corresponding groove cut in the plate, as shown at Fig. 25. The rollers F are carried upon the exterior surface of the tubes B<sup>3</sup>, being free to revolve upon the same when the chain is working. The joint or pivot connection between the inner side plates A' and the outer plates A<sup>2</sup> is formed by a second open-jointed hard tube similar to B<sup>3</sup>, but of such an external diameter and length as to permit of its being passed through the tube B<sup>3</sup> and into the holes formed in the outer side plates, within which it is tightly expanded by the solid central pin E.

In the roller-chain illustrated at Figs. 27 and 28, the inner side plates, preferably of the form shown at the lower part of Fig. 29, are connected together by the outer hard tubes, such as shown at Fig. 30, which carry the rollers E. The joint or pivot connection with the outer plates, which are preferably of the form shown at the upper part of Fig. 29, is made by means of the hard tube shown at Fig. 31, which passes through the outer tube, and fits within the outer plates. The soft-steel tube shown at Fig. 32 is then passed through the inner hard tube and its serrated ends pressed or flanged over onto the outer surfaces of the outer side plates. The ends of tubes in the outer side plates are then tightly expanded in the holes by the insertion of the solid pin E, as shown at Figs. 27 and 28.

For the purpose of providing a simple means for readily coupling the terminal links to form the complete endless chain for a cycle or other machine, I make a loose or detachable joint-pin connection between such terminal links, and keep the same in its position by means of a spring-cap or retaining-plate arranged in the manner illustrated by Figs. 33 and 34.

Referring to Fig. 33, I employ a solid hard steel pin G, which fits sufficiently freely within the side plate A and block D of the chain as to permit of its ready insertion or withdrawal. Accidental detachment of the pin when in service is prevented by the spring-cap or retaining-plate H, which is made from one piece of thin sheet-steel formed to the shape shown by the elevation and plan at Fig. 33. The cap or retaining-plate is hinged or pivoted to the side plates of the link upon small circular projecting pieces pressed up from the sheet-steel, which fit within holes or recesses in the side plate in such a manner as to permit of the cap being turned up to the position shown by dotted lines when it is required to withdraw the pin. When the cap is pressed down to its closed position, its



sides or free ends spring over the outer surfaces of the plate, and thus prevent lateral movement of the pin G.

5 The spring-cap H, as shown in the two views at Fig. 34, consists of a single plate hinged, by means of a small pin, to one of the outer plates only. The pin G is provided with a head at one end, as shown in the plan or lower view at Fig. 34, and its opposite end  
10 has a screw-thread cut or formed around it for screwing into the side plate of the link. The screwed end has also flat sides, as shown at the upper view at Fig. 34, corresponding with the flat sides of the slot or aperture in  
15 the spring-cap H. When the cap is closed down, it is caused to spring over the projecting end of the pin, thus preventing the same from accidental turning or unscrewing. The pin can be readily unscrewed and withdrawn  
20 if required after opening the cap to the position shown by the dotted lines.

In the construction of a chain with two or more blocks or bearing-pieces D, as shown at Figs. 35 and 36, I employ inner plates, such

as A<sup>3</sup>, pivoted or arranged between the outer 25 plates A, as illustrated, and also additional inner strengthening-plates, such as A<sup>4</sup>, similar to the outer plates A.

Having thus described my invention, I declare that what I claim, and desire to secure 30 by Letters Patent, is—

1. A drive-chain comprising the side plates, a hardened split bush and a soft split bush having its ends flanged over onto the outer 35 surface of the links.

2. In combination, the side plates, the cross pins or connections between the plates and means for holding one of said pins removably consisting of the cap pivotally carried by the side plate and removable to and from posi- 40 tion over the end of the pin, substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

JOSEPH APPLEBY.

Witnesses:

EDWARD MARKS,  
HERBERT BOWKETT.