April 5, 1949. A. E. FOCKE ET AL 2,466,639

CHAIN

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Fig. 1.

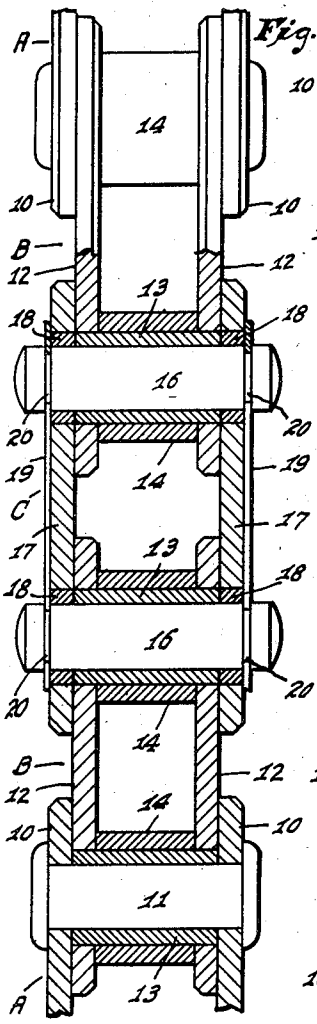


Fig. 2.

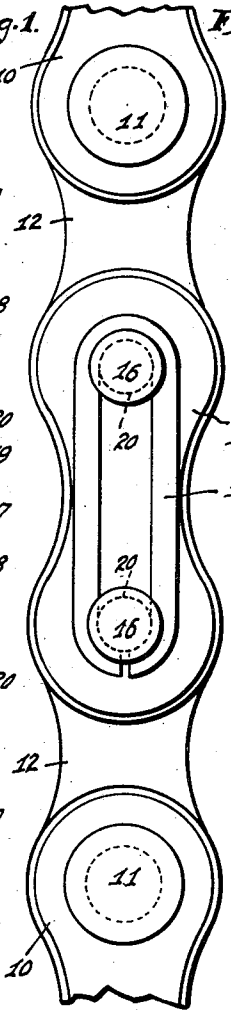


Fig. 3.

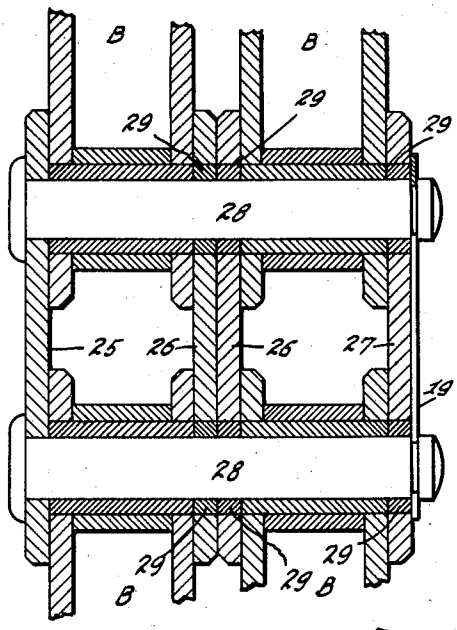


Fig. 5.

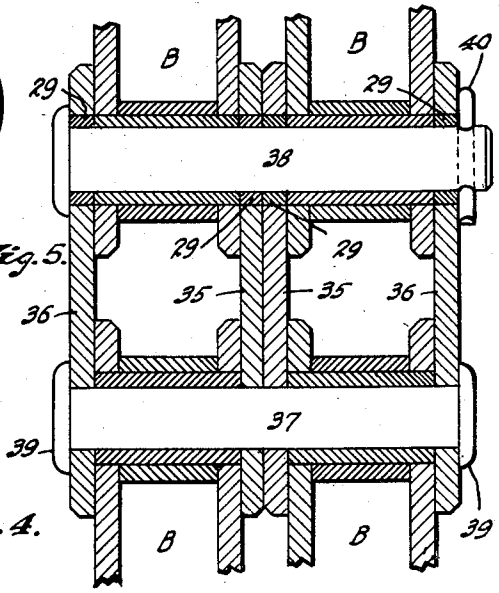
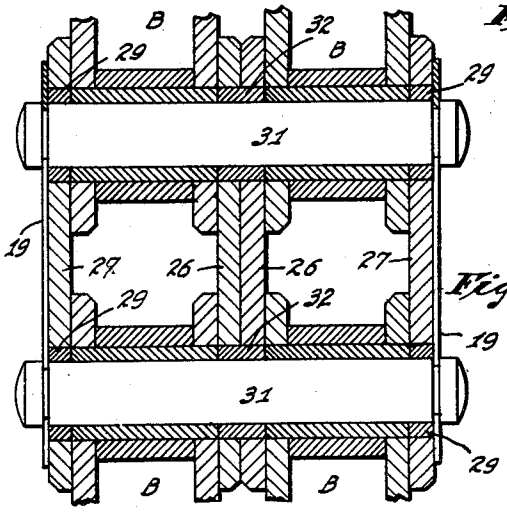


Fig. 4.



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CHAIN

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14 Claims. (Cl. 74—251)

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Our invention relates to chain, and more particularly to the form of chain, commonly used in power-transmission, which is made up of links embodying longitudinally extending, tension-transmitting plates and interconnected by interfitting pins and bushings having a press-fit within holes in the plates. It has previously been discovered (see U. S. Letters Patent No. 2,424,084, granted July 15, 1947, on the application of A. E. Focke and G. G. Mize) that the fatigue properties of the plates in such a chain can be improved by increasing the tightness of the fit between the plates and the pins or bushings which they receive. To obtain optimum fatigue properties by this means, relatively large forces are required to force the pins and bushings into the plate-holes which receive them. In the case of a connecting link, in which a plate must frequently be applied to or removed from associated pins in the field with the chain in place over sprockets, it is a practical impossibility to obtain between the pins and the removable plate the tightness of fit necessary to produce improved fatigue properties. Moreover, in the case of multiple-strand chain, where relatively long pins must be forced through a multiplicity of plates, the difficulties in effecting assembly frequently limit the tightness of fit to a point well below that necessary for the best fatigue properties.

It is the object of our invention to facilitate the assembly of chains or the removal and application of a plate in a connecting link while retaining in the chain the advantages in respect to improved fatigue resistance which follow the use of tight press-fits between the pins and pin plates.

In carrying out our invention, we provide the pin plates with pin-receiving holes materially larger than the pins they are to receive, and in those holes we place bushings. In such a construction, the fatigue properties of the pin plates are affected by the tightness of the fit between the bushings and the pin plates, while the ease with which pins can be inserted or put in place will depend upon the tightness of the fit between the pins and bushings. Accordingly, the bushings may be made to fit the holes of the plates with a fit tight enough to enhance measurably the fatigue properties of the plates, while the pins may fit the bushings with any degree of looseness which considerations of assembly or disassembly dictate.

The accompanying drawing illustrates our invention: Figs. 1 and 2 are, respectively, a plan view and a side elevation of a single-strand chain containing a connecting link embodying our invention, portions of Fig. 1 being broken away and shown in section; Fig. 3 is a view similar to Fig. 1 illustrating a connecting link for multiple-strand chain; and Figs. 4 and 5 are views similar to Fig. 3 illustrating modified constructions.

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The chain shown in Figs. 1 and 2 is a roller chain made up of alternating pin-links and roller-links designated respectively by the reference letters A and B. The chain terminates in roller links B adapted to be interconnected by a connecting link C.

As shown, the pin-links A and roller-links B are of standard construction. Each pin link A comprises a pair of spaced plates 10 between which there extend a pair of spaced pins 11 having a press-fit in holes at the ends of the pin plates. Each roller-link B comprises a pair of spaced inner side plates 12 and a pair of spaced bushings 13 having a press-fit in holes at the ends of those side plates. The pins 11 of each pin-link extend through and are rotatable in the bushings 13 of adjacent roller-links. The fit of the pins 11 in the side plates 10 and of the bushings 13 in the side plates 12 is desirably of the character set forth in the aforesaid co-pending application of A. E. Focke and G. G. Mize. Sprocket-engaging rollers 14 are rotatably mounted on the bushings 13; but such rollers may be omitted if direct contact of the bushings with the sprocket teeth is desired.

The connecting link C, which embodies our invention, comprises a pair of spaced pins 16 rotatably received in the bushings 13 at the end of the chain. The pins 16 project outwardly beyond the ends of the bushings 13 and extend through holes in cover plates 17 located on opposite sides of the chain. Each of the cover plates 17 is provided with bushings 18 for the receipt of the ends of the pins 16. The fit of the bushings 18 within the cover plates 17, and the fit of corresponding bushings in other constructions described below, is tighter than the fit of the pins 16 within the bushings, and desirably is of the tightness set forth for bushings in the aforesaid co-pending application—i. e., each bushing desirably fits the hole in the cover plate with a tightness such that the force in pounds required to expel it is at least 16,000 DT, where D and T are, respectively, the external diameter of the bushing and the thickness of the cover plate in inches.

The fit of each pin within its associated bushings 18 may be as tight as desired; but ordinarily no useful purpose would be served in having such fit tighter than a light press-fit. For example, each pin 16 may have a slip fit within

its associated bushings 18, in which event it will be necessary to provide some means for keeping the pin in place to prevent it from working out of the chain while the chain is in operation. The means illustrated in Fig. 1 for accomplishing this purpose is one commonly used, especially in smaller sizes of chain, to retain a removable cover plate on a connecting link. It comprises a split loop of spring material 19 adapted to be received in annular grooves 20 near the ends of the pins 16. If desired, other forms of means for retaining the cover plate in position may be used, or such means may be eliminated entirely and the pins given a press fit within the bushings 18, such press fit being sufficiently tight to prevent the pins from working out of the cover plating during operation of the chain but not too tight to interfere with relatively easy removal of the cover plate to permit disconnection of the chain.

It is not essential in a connecting link that both cover plates be removable from their associated pins, as the pins may fit one of the cover plates with sufficient tightness to establish a permanent connection. Such a construction is illustrated in Fig. 3, where we have shown a connecting link for multiple-strand chain, specifically a two-strand chain. The connecting link of Fig. 3 comprises a pin plate 25, two center plates 26, a cover plate 27, and two pins 28. The two center plates 26 are disposed between roller-links B at each end of the two-strand chain, while the pin plate 25 and cover plate 27 are located on opposite sides of the two-strand chain with the pins 28 extending the full width of the chain and passing through the pin plate and cover plate. The pins 28 fit the pin plate 25 with a tight press-fit, desirably of the tightness set forth for pins in the aforesaid co-pending application. The cover plate 27 and each center plate is provided with bushings 29 which have a tight press-fit in the plates 26 and 27 and receive the pins with a fit not too tight to prevent removal of the cover plate from the pins when it is desired to disconnect the ends of the chain. In the particular link shown in Fig. 3, it is contemplated that the pins will have a slip fit within the bushings 29 and that the cover plate will be held in place by some means such as the spring-clip 19.

The modified form of multiple-strand connecting link illustrated in Fig. 4 embodies the two center plates 26 and two removable cover plates 27 located on opposite sides of the chain, each of such cover plates being held in place on the pins 31 by means of spring-clips 19. Each of the cover plates 27 is provided at each end with a tightly fit bushing 29, like that previously described. The center plates 26 are also provided with tightly fit bushings; but in this instance, instead of providing each hole in each center plate with its individual bushing as was done in the case of the chain shown in Fig. 3, we employ on each pin 31 a single center bushing 32 long enough to extend through both center plates.

In the chain illustrated in Fig. 5 the connecting link is not removable in its entirety from association with the remainder of the chain, but instead embodies a single removable pin by the insertion or removal of which the ends of the chain can be connected or disconnected. In this construction, the connecting link embodies a pair of center plates 35, a pair of outer plates 36, and a pair of pins 37 and 38. The pin 37 has a tight press fit within both plates 35 and both plates 36, and may be headed as indicated at 39 beyond the outer surfaces of the outer plates 36. The opposite ends

of the plates 35 and 36 are provided with tightly fit bushings 29 which receive the pin 38 with a slip fit or a relatively light press fit. Where the pin 38 has a slip fit within the bushings 29 it may be provided at one end with a head 39 and at the other end with a removable cotter-pin 40 removably holding it in place in the chain.

It is not essential in the multiple-strand chains illustrated that there be two center plates in each pin link. Further, multiple-strand chains embodying our invention may have more than two strands.

While we have illustrated and described our invention as embodied in connecting links, it will be obvious that it can be embodied in pin-links throughout the chain. Even if the pins were headed or fit the bushings which receive them with a fit too tight to permit the ready removal of side plates, such a chain would still possess the advantage of ready assembly. In other words, it might be desirable, especially in the case of multiple-strand chain, to use the bushings 18 or 29 even in pin links which are not intended for disassembly; as the short bushings could readily be forced into the pin plates with a fit sufficiently tight to effect a material improvement in the fatigue properties of the pin plates, while the pins could fit the bushings with a fit not too tight to prevent their ready insertion.

Obviously, since the bushings 18 or 29 require larger holes in the pin plates than would be required for the pins themselves bushed pin plates should be widened at the ends or made of thicker stock in order to prevent reduction of their strength in tension. We prefer to make the bushings 18 or 29 of the same nominal diameter as the bushings 13 of the roller links and to make the bushed outer and center pin-link plates of substantially the same dimensions as the inner side-plates 12 of roller links.

While we have used the term "bushings" throughout the above specification to designate the pin-receiving, stress-creating elements 18 and 29, we shall employ the term "liners" for these elements in the claims, in order to avoid possible confusion between them and the ordinary roller-supporting or sprocket-engaging bushings commonly employed in chain.

We claim as our invention:

1. In a chain, a pin link comprising spaced plates extending longitudinally of the chain and two spaced transverse pins extending through said plates and pivotally associated with adjacent links of the chain, at least one of said pin-link plates being provided with liners which respectively receive said pins, each liner having a press fit within its associated pin-link plate and the fit of each pin within its associated liner being looser than the fit of the liner within the plate, whereby the pins can be inserted into or removed from the liners by the application of a force less than that necessary to dislodge any liner from the plate in which it is disposed.

2. In a chain, a pin link comprising spaced plates extending longitudinally of the chain and two spaced transverse pins extending through said plates and pivotally associated with adjacent links of the chain, said pin-link plates being provided with liners receiving at least one of said pins, each liner having a press fit within its associated pin-link plate and the fit of the pin within its associated liner being looser than the fit of the liner within the plate, whereby the pin can be inserted into or removed from the liners by the application of a force less than that neces-

sary to dislodge any liner from the plate in which it is disposed.

3. In a chain, a link comprising spaced plates extending longitudinally of the chain and a transverse pin extending through said plates, a second link having an end portion disposed between said plates and provided with an opening pivotally receiving said pin, at least one of the side plates of the first link being provided with a liner within which said pin is non-rotatably received, said liner having a press fit within its associated plate and the fit of the pin within the liner being looser than the fit of the liner within the plate, whereby the pin can be inserted into or withdrawn from the liner by the application of a force less than that necessary to dislodge the liner from the plate in which it is disposed.

4. The invention set forth in claim 3 with the addition that the fit of the liner within the plate is such that the force in pounds necessary to expel it from the plate is at least 16,000 DT, where D and T are, respectively, the outside diameter of the liner and the thickness of the plate in inches, said pin having a slip fit within said liner and said link being provided with releasable means for holding the pin in place.

5. The invention set forth in claim 3 with the addition that the fit of the liner within the plate is such that the force in pounds necessary to expel it from the plate is at least 16,000 DT, where D and T are, respectively, the outside diameter of the liner and the thickness of the plate in inches.

6. The invention set forth in claim 3 with the addition that said pin has a slip fit within said liner, said link being provided with releasable means for holding the pin in place.

7. In a chain, a pin link comprising two plates disposed on opposite sides of the chain and extending longitudinally thereof and two spaced transverse pins extending through said pin-link plates and pivotally associated with adjacent links of the chain, said pins having a tight press fit within one of said plates, the other of said pin-link plates being provided with liners which respectively receive said pins, each liner having a press fit within its associated plate and the fit of each pin within its associated liner being looser than the fit of the liner within the plate, whereby the pins can be inserted into or removed from the liners by the application of a force less than that necessary to dislodge any liner from the plate in which it is disposed.

8. In a multiple-strand chain, a pin link comprising a plurality of spaced plates extending longitudinally of the chain and two spaced transverse pins extending through said plates and pivotally associated with adjacent links of the chain, said pins having a tight press fit within one of said pin-link plates, at least one other of said pin-link plates being provided with liners which respectively receive said pins, each liner having a press fit within its associated plate and the fit of each pin within its associated liner being looser than the fit of the liner within the plate, whereby the pins can be inserted into or removed from the liners by the application of a force less than that necessary to dislodge any liner from the plate in which it is disposed.

9. In a chain, a pin link comprising two plates disposed on opposite sides of the chain and extending longitudinally thereof and two spaced transverse pins extending through said plates and pivotally associated with adjacent links of the chain, both said pin-link plates being provided with liners which respectively receive said pins, each liner having a press fit within its associated plate and the fit of each pin within its associated liner being looser than the fit of the liner within the plate, whereby the pins can be inserted into or removed from the liners by the application of a force less than that necessary to dislodge any liner from the plate in which it is disposed.

10. In a chain, a pin link comprising two plates disposed on opposite sides of the chain and extending longitudinally thereof and two spaced transverse pins extending through said plates and pivotally associated with adjacent links of the chain, one of said pins having a tight press fit within both said pin-link plates, said pin-link plates being provided with liners for the reception of the other of said pins, each liner having a press fit within its associated plate and the fit of the pin within its associated liner being looser than the fit of the liner within the plates, whereby the pin can be inserted into or removed from the liners by the application of a force less than that necessary to dislodge any liner from the plate in which it is disposed.

11. The invention set forth in claim 10 with the addition that said chain is a multiple-strand chain, said pin link including at least one center plate having a tight press fit on one pin and being provided with a liner for the reception of the other pin.

12. A connecting link for chain, comprising a pair of plates spaced from each other to receive between them the links at the ends of the chain, and two pins extending through said plates and adapted to be pivotally received in said chain-links, said pins having a tight press fit within one of said plates, the other of said plates being provided with liners which respectively receive said pins, each liner having a press fit within its associated plate and the fit of each pin within its associated liner being looser than the fit of the liner within the plate, whereby the pins can be inserted into or removed from the liners by the application of a force less than that necessary to dislodge any liner from the plate in which it is disposed.

13. A connecting link for multiple-strand chain, comprising at least three parallel plates spaced to receive between them the links at the ends of the chain, and two spaced transverse pins extending through said plates and adapted to be pivotally received in said chain-links, said pins having a tight press fit within one of said plates, at least one other of said plates being provided with liners which respectively receive said pins, each liner having a press fit within its associated plate and the fit of each pin within its associated liner being looser than the fit of the liner within the plate, whereby the pins can be inserted into or removed from the liners by the application of a force less than that necessary to dislodge any liner from the plate in which it is disposed.

14. A connecting link for chain, comprising a pair of plates spaced from each other to receive between them the links at the ends of the chain, and two pins extending through said plates and adapted to be pivotally received in said end chain-links, both said connecting-link plates being provided with liners which respectively receive said pins, each liner having a press fit within its associated plate and the fit of each pin within its associated liner being looser than the fit of the liner within the plate, whereby the pins

can be inserted into or removed from the liners by the application of a force less than that necessary to dislodge any liner from the plate in which it is disposed.

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