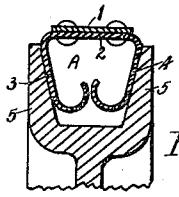
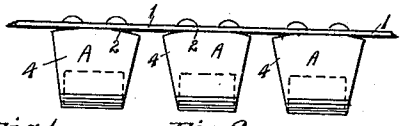
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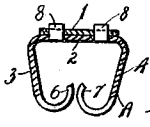
W. R. KEEN

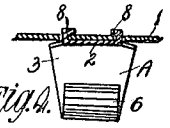
FLEXIBLE DRIVING ELEMENT

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Fig.1.


Fig.2.


Fig.3.


Fig.4.

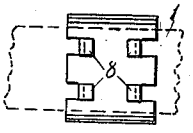
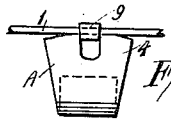
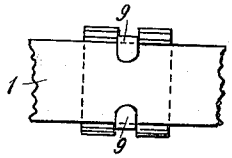
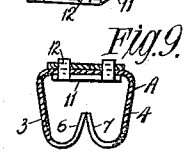
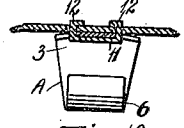

Fig.5.

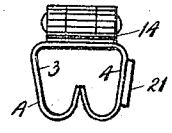

Fig.6.

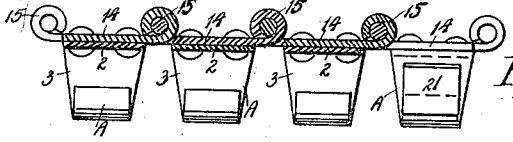

Fig.7.

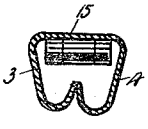

Fig.8.

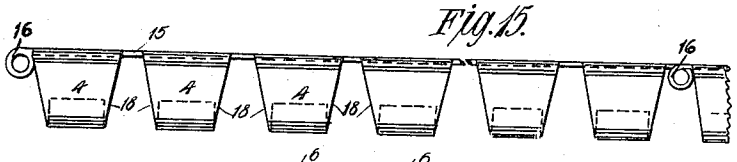

Fig.9.

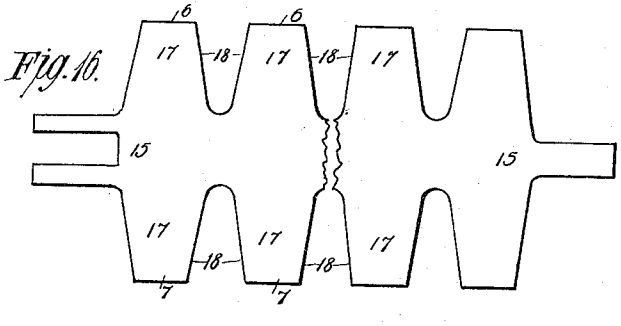

Fig.10.

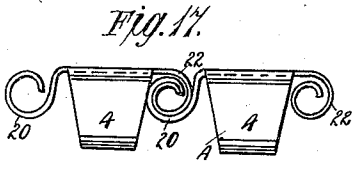

Fig.12.


Fig.13.


Fig.14.


Fig.15.


Fig.16.


Fig.17.

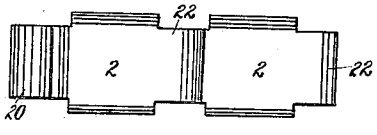
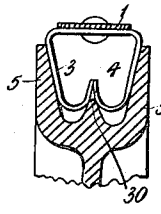

Fig.18.


Fig.19.


Fig.20.

Inventor
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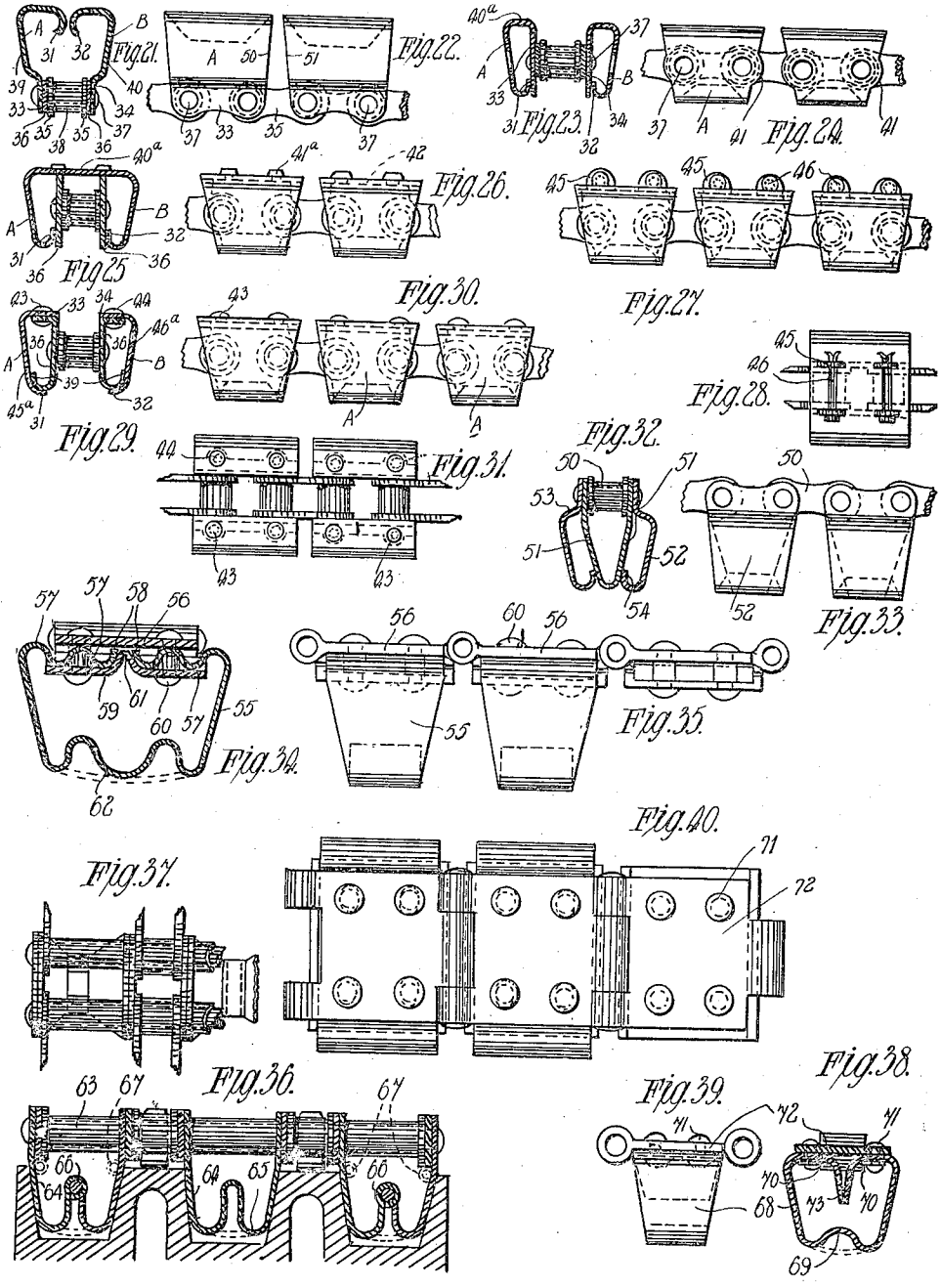
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Inventor
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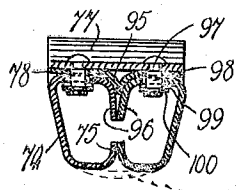


Fig. 41.

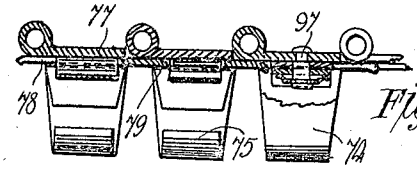


Fig. 42.

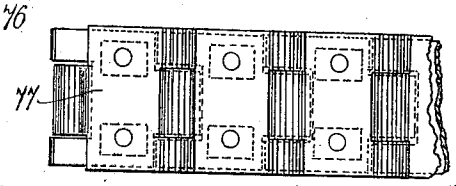
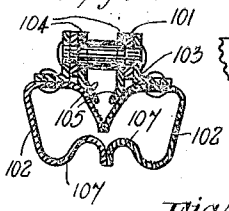


Fig. 43.

Fig. 44.



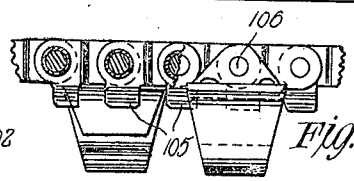


Fig. 45.

Fig. 47.

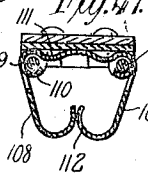


Fig. 48.

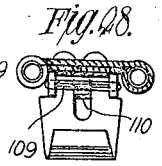


Fig. 46.

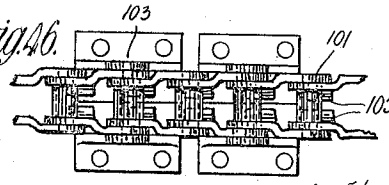


Fig. 49.

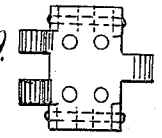


Fig. 50.

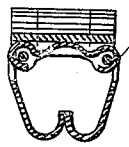


Fig. 51.

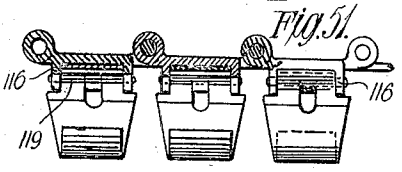


Fig. 54.

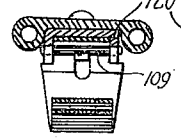
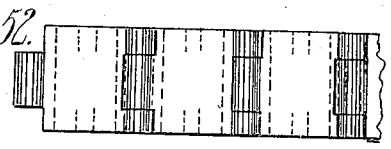


Fig. 53.



Fig. 52.



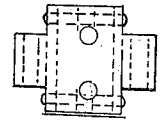
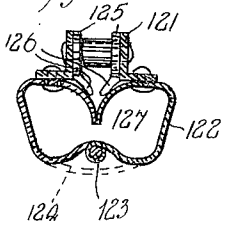


Fig. 55.

Fig. 56.



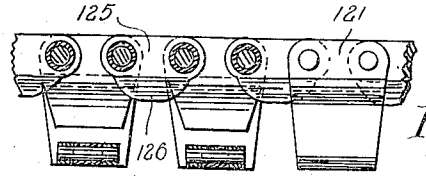
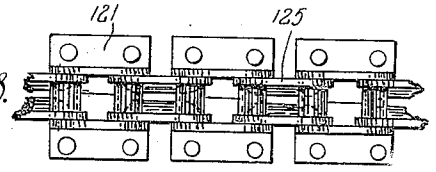


Fig. 57.

Fig. 58.



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Fig. 59.

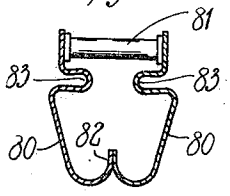


Fig. 60.

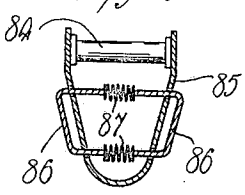


Fig. 61.

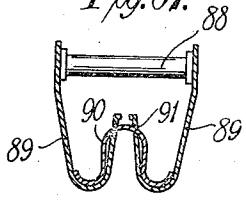


Fig. 62.

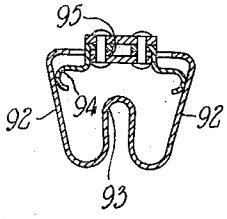


Fig. 63.

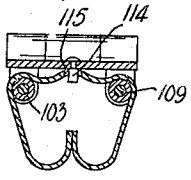
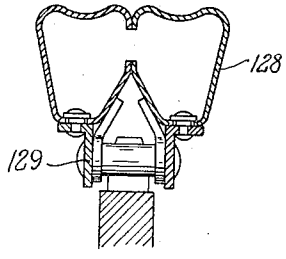


Fig. 64.



Inventor-
Walter Reuben Keen.
By- B. Singer.
Atty

Patented July 8, 1924. 1,500,458

UNITED STATES PATENT OFFICE.

WALTER REUBEN KEEN, OF BIRMINGHAM, ENGLAND.

FLEXIBLE DRIVING ELEMENT.

Application filed December 29, 1920. Serial No. 433,913.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, WALTER REUBEN KEEN, a subject of the King of Great Britain, residing at 87 Slade Road, Erdington, Birmingham, in the county of Warwick, England, have invented certain new and useful Improvements in Flexible Driving Elements (for which I have filed applications in Great Britain July 26, 1918, Serial No. 128,775, December 24, 1919, No. 32,275, and December 1, 1920, No. 33,858); and I do hereby declare the following to be a full, clear, and exact description of the same.

This invention relates to flexible driving elements of the kind which include a flexible band provided with resilient inclined gripping members adapted to engage with a pulley having a groove of V or other section.

One of the objects of the present invention is to provide a generally improved construction including means for preventing the gripping members from being permanently displaced or distorted by the forces which come into play when they are forced into the groove of the pulley.

The object is carried out by providing one or more transverse portions which extend between the resilient inclined gripping members, which transverse portion or portions are adapted to be distorted by inward compression upon the inclined gripping members.

Another object of the present invention is to so construct the transverse portion or portions which force the inclined gripping members that it or they provide a resilient backing for the said inclined gripping members.

A further object of the present invention is to provide means to prevent the bodily displacement in a transverse direction of the transverse portion or portions which serve to support the inclined gripping members.

A further object of the present invention is to construct the transverse portion or portions with curves which mutually support each other against the forces resulting from transverse compression of the inclined gripping members.

A further object of the present invention is to provide a construction in which an accurately pitched driving sprocket chain is combined with the inclined resilient gripping members whereby the driving element may run at one end upon a driving sprocket and at the other end upon a grooved pulley.

Referring to the drawings:—

Figure 1 is a cross sectional elevation of one form of driving belt constructed in accordance with this invention, this view also showing a portion of one of the driving pulleys with which it is used.

Figure 2 is a side elevation of the same.

Figure 3 is a cross sectional elevation, Figure 4 is a longitudinal sectional elevation, and Figure 5 is a plan of a portion of a driving belt made according to a modification of my invention.

Figure 6 is a cross sectional elevation, Figure 7 is a side elevation, and Figure 8 is a plan of a portion of a driving belt illustrating a further modification of my invention.

Figure 9 is a cross sectional elevation, and Figure 10 is a longitudinal sectional elevation of a portion of a driving belt constructed according to a further modification of my invention.

Figure 11 is a perspective view of one of the clip parts of the arrangement illustrated in Figures 9 and 10.

Figure 12 is an end elevation, and Figure 13 is a sectional side elevation of a portion of a driving chain constructed in accordance with this invention.

Figure 14 is a cross sectional elevation, and Figure 15 is a side elevation of a portion of a driving belt illustrating a further modification of my invention, and

Figure 16 is a plan of the sheet steel blank for forming a section of the driving belt illustrated by Figures 14 and 15.

Figure 17 is a side elevation of a portion of a driving belt illustrating a further modification of my invention, and Figure 18 is a plan of the same.

Figure 19 is an end elevation of a further modification of my invention, and

Figure 20 is a cross sectional elevation of a portion of a driving belt constructed according to a further modification of my invention and showing also in cross section a portion of one of the driving pulleys of the same.

Figure 21 is a cross sectional elevation

of one form of driving belt or driving chain constructed in accordance with this invention.

Figure 22 is a side elevation of same.

Figure 23 is a cross sectional elevation and Figure 24 is a side elevation of a portion of a driving belt or chain made according to a modification of my invention.

Figure 25 is a cross sectional elevation and Figure 26 is a side elevation of a portion of a driving belt or chain illustrating a further modification of my invention.

Figure 27 is a cross sectional elevation and Figure 28 is a plan of a portion of a driving belt or chain constructed according to a further modification of my invention.

Figure 29 is a cross sectional elevation, Figure 30 is a side elevation and Figure 31 is a plan of a portion of a driving belt or chain constructed in accordance with this invention and illustrating a further modification of my invention.

Figure 32 is a view in cross section showing a further modification.

Figure 33 is a side view corresponding to Figure 32.

Figure 34 is a cross section showing a further modification.

Figure 35 is a side elevation corresponding with Figure 34.

Figure 36 is a cross section showing a further modification.

Figure 37 is a fragmentary plan view corresponding with Figure 36.

Figure 38 is a view in cross section showing a further modification.

Figure 39 is a side view corresponding to Figure 38.

Figure 40 is a plan view of the construction shown in Figure 38.

Figure 41 is a sectional view showing a further modification.

Figure 42 is a corresponding side elevation.

Figure 43 is a plan view corresponding to Figure 42.

Figures 44, 45 and 46 are views in section, side elevation and plan respectively of a further modification.

Figures 47, 48 and 49 are views in section, side elevation and plan respectively of a further modification.

Figures 50, 51 and 52 are views in section, side elevation and plan respectively of a further modification.

Figures, 53, 54 and 55 are views in section, side elevation and plan respectively of a furthere modification.

Figures 56, 57 and 58 are views in section, side elevation and plan respectively of a further modification.

Figure 59 is a view in cross section showing a further modification.

Figure 60 is a view in cross section showing a further modification.

Figure 61 is a view in section showing a further modification.

Figure 62 is a view in section showng a further modification.

Figure 63 is a view in section showing a further modification.

Figure 64 is a view in section showing a further modification.

In the arrangement of my invention illustrated by Figures 1 and 2 a flexible thin sheet metal or other suitable metal driving band 1 is employed made of one thickness or laminated, that is made of two or more thicknesses fixed together. Riveted or otherwise fixed to that side of this band 1 which is next to the pulleys are the inclined sided metal wedge shaped gripping members A each of which is formed of an elongated sheet steel or other suitable sheet metal blank which is bent so as to form a flat or curved base 2 which is riveted or otherwise fixed to the driving band 1 and at the two sides 3, 4 of this, the two portions of the blank are bent so that they are in planes which form acute angles with the base so as to form the two inclined sides of the gripping member which bear against the pulley flanges 5 and the end portions of these parts 3, 4 are bent towards one another and curved inwardly at 6, 7 so as to touch one another (see Figure 1) when pressed into the pulley groove and thus resist the lateral inward pressure of the pulley sides. Thus the sides 3, 4 form springs which are to a certain extent resilient as aforesaid and afford a perfect grip on the pulleys and are strengthened by their ends being curved to bear against one another as aforesaid.

These wedge like spring gripping members A made with inwardly curved ends as aforesaid are fixed to the band 1 close or nearly close together (see Figure 2) and their adjacent edges are inclined from each other sufficiently to allow of the band 1 bending properly round the smallest size pulley with which the band is intended to be used.

Instead of the gripping members A being secured to the inside of the band 1 by riveting, they may be secured thereto by any other suitable means such for instance as by each member A being provided with tongues 8 (see Figures 3, 4 and 5) which are pierced and raised from the base part 2 and pass through holes in the band 1 and are closed over on the other, that is the outer, side of the same. Or as shown in Figures 6, 7 and 8 the tongue like clips 9 may be pierced and raised out of the spring side portions 3, 4 and be raised and closed over the sides of the band 1 so as to grip the same between the base 2 and these tongues 9. Or as shown in Figures 9, 10 and 11 each member A may be secured to the band by an independent clip

which is made of a plate 11 adapted to fit against the inside of the base part 2 and made with upstanding tongues 12 which pass through holes in the band and are clenched over on the upper side of the same as shown in Figure 10. Or any other convenient means may be employed for securing the spring gripping members A to the band.

It is to be understood that the band, instead of being a thin flexible metal driving band, may be formed of leather or balata or cotton or other suitable material or it may be a stranded wire band or unstretchable cord with the gripping members secured thereto in any suitable manner.

As a further modification instead of employing a driving band to carry the resilient inclined sided gripping members A constructed with the incurved ends 6, 7 as aforesaid I may as shown for instance in Figures 12 and 13 employ a driving chain preferably formed of flat links 14 jointed together by well known pin and eye connection at their ends 15 or jointed together in any other suitable manner and each link 14 being of the proper size and carrying one of the gripping members A which is secured thereto by riveting or by other suitable means, the joints of the chain between two links thus being between two gripping members.

Or, as a further modification, (see Figures 14, 15 and 16) the gripping members A may be made in a piece with the steel or other metal band, in this case marked 15, which will be made in comparatively short lengths (or they may be made in long lengths) and when in short lengths these will be hinge jointed or otherwise connected together as at 16 each length 15 being formed of a sheet steel or other suitable sheet metal blank (see Figure 16) having inclined laterally projecting tongues 17 at each side corresponding with the required gripping members and these projections 17 are then raised and bent towards one another making an acute angle with the sides of the central portion 15 which forms the band and the ends 6, 7 of the tongues are bent and curved inwardly so as to bear against one another or so as to almost touch one another, and thus the two opposed tongues constitute one of the inclined spring sided gripping members, the adjacent edges 18 of the tongues being inclined as shown so as to permit of the band bending round the smallest size pulley with which it is intended to be used.

Or as a further modification (see Figures 17 and 18) the base part of each of the gripping members A may have at the front a hooked projecting portion 20 and a corresponding hooked projection 22 at the back formed integral with the base or fixed thereto the end 20 of one gripping member being adapted to engage with the corresponding hooked portion 22 of the next gripping member and thus the required member or members will form a combined hook jointed driving chain and wedge shaped gripping member.

If desired, in order to increase the frictional grip on the flanges of the spring sided wedge shaped gripping members A on the pulleys, the inclined faces 3, 4 of each gripping member A may have fixed to it one or more pads of leather, india rubber or other suitable material such for instance as the pad 21 illustrated in Figures 12 and 13.

Moreover if desired in order to stiffen the spring sides 3, 4 of the gripping members A each gripping member can have between its sides an additional spring or springs such as a leaf spring 28 in Figure 19 made with a base part and two arms 23, 24, the base being fixed to the underside of the base 2 of the gripping member A and the two arms 23, 24 of the leaf spring being bent outwardly and downwardly to bear against the inner surfaces of the inclined sides 3, 4. Or for the same purpose a coiled wire spring may be arranged between the inclined sides 3, 4 so as to assist in springing them outwardly.

Moreover as a further modification the pulleys on to which the belt or chain formed with the said gripping members A drives may, instead of being each made with a single inclined sided groove for the gripping members to engage with, as is usual and as shown in Figure 1, said pulleys may have on the bottom of each groove an upwardly projecting inclined sided rib 30 (see Figure 20) thus forming an approximate V groove which has two small V grooves at the bottom of it so that it resembles the letter W and this rib 30 when the band is at work projects up between the central divisions of the under sides of the gripping members where the said sides meet (see Figure 20) and thus the inclined sided central rib 30 forms two additional gripping surfaces which tends to force the sides 3, 4 of the gripping members against the inclined sides of the flanges 5 of the pulley thus increasing the grip.

In the construction illustrated by Figures 21 and 22 a sprocket chain formed in the manner which is well understood and consisting of metal links 35, 35, roller 38 and joint pins 37, has secured to its outside links 36, 36 by the joint pins 37 the inclined sided metal wedge shaped gripping members A and B, each of which is formed of an elongated sheet steel or other suitable sheet metal blank which blanks are bent so as to form flat surfaces 33, 34 to seat against the side links 36. The sides 39, 40 of these blanks are bent or cranked so as to slope outwardly and are then bent inwardly towards one another and the end portions are bent and curved inwardly at 31, 32 so as

to touch one another (see Figure 21) when pressed into the pulley groove and thus resist the lateral inward pressure of the pulley sides.

Thus the members A, B form a wedge shaped section and being formed as hereinbefore described the sides 39, 40 form springs which are to a certain extent resilient and afford a perfect grip on the pulleys and are strengthened by their ends being curved to bear against one another.

These wedge like gripping members A, B are fixed to the opposite side plates of the alternate links of the chain belt (see Figure 22) and their adjacent edges 50, 51 are either parallel to each other or converge but a sufficient clearance or space between their extreme edges is allowed so that the chain belt can run properly when passing between the driver and the driven element. The gripping members being above that part of the chain belt which engages with the sprocket wheel, allow the teeth of the sprocket wheel to engage with the rollers of the sprocket chain satisfactorily. The grooved pulley with which it is intended to use the chain belt has the groove which engages the gripping members A, B sufficiently deep to give proper clearance at the bottom of the groove when the said gripping members are in driving contact with the pulley flanges.

Instead of the gripping members A, B being secured to the chain belt by riveting they may be secured to the side plates of the chain belt by other suitable means such as by making the joint pins of the chain belt with screwed ends and securing the gripping members by nuts, or bolts and nuts could be used as joint pins and for securing the said gripping members to the chain belt, or any other convenient means may be employed for securing the grippers to the chain belt.

It is to be understood that it is only necessary to use an accurately pitched chain belt when it is desired to transmit power by a pair of sprockets or by a sprocket wheel and pulley, as when the chain belt is only required for a friction drive the construction may be modified, for instance, the rollers 38 would not be required and a seamless or other like oval steel ferrule could be substituted for the side plates or links 35, 35, the band being of sufficient width to fill the space between the outer plates or links 36, 36.

As a modification the gripping members A, B, may be made so that their horizontal centre line coincides or nearly coincides with the centre line of the chain belt, that is the gripping faces or sides 39, 40 of the gripping members A, B are level with the chain belt 36, 35 (see Figures 23 and 24). The gripping members A, B are formed of blanks shaped differently from those illustrated in Figure 21 and are made out of sheet steel or other suitable metal of an elongated form with the opposite sides inclined towards each other and flat parts 40^a which are not quite central with the blanks. The said inclined sides have projected portions 41, 41 so as to leave sufficient metal around the rivets 37, and also around the holes in the sides of the said grippers A, B at 39, 40, the said holes being for the purpose of inserting the rivets and to allow of same being riveted over by a suitable punch to secure the grippers in position. The gripping members have flat sides 33, 34 which project above and extend below the side plates of the chain belt. The part of each gripping member which projects above the top edge of the side plate is of sufficient length to allow of same being bent over in an outward direction from the chain belt side plate to form the flat top 40^a, then bent downward and inclined inwardly so that the ends touch or nearly touch one another or the ends 31, 32 of the downwardly inclined part of the gripping members A, B may be bent inwardly and curled upwards as illustrated so as to touch or nearly touch the flat sides 33, 34 or the said gripping member, or they may be curled downwardly so as to touch or nearly touch the lower ends of the flat sides 33, 34 of said gripping members A, B. These gripping members may be fixed to the opposite side plates of the alternate links of the chain belt by riveting or in any other suitable manner as aforesaid, and have their adjacent sides inclined from each other sufficiently to allow of the chain belt making the necessary angular movement when passing round the smallest size sprocket or pulley with which it is intended to be used, and they conform in their transverse section to the section of the V or like grooved pulley element of the transmission.

The grippers may be made integral with the side links of the chain.

As a further modification (see Figures 25, 26, 27 and 28) the gripping members with sides A, B may be made in one piece, and the side plates 36, 36 of the chain belt made of a shape different from those hereinbefore described and have their top and bottom edges extended a suitable distance to allow of the said gripping members being secured to same at their top face 40^a, and to form a bearing for the curled ends 31, 32 of said grippers. The blanks to form the gripping members as illustrated by Figures 25, 26, 27 and 28 are formed from sheet metal having a parallel central part which forms the top 40^a and two side portions which are inclined towards one another. The end portions of those parts A, B are bent towards the side plates 36 and inwardly curved at 31, 32 so as to touch the side plates 36 (see Figure 25) when pressed into the pulley

groove and thus resist the lateral inward pressure of the pulley flanges or sides. Thus the sides A, B form springs which are to a certain extent resilient as aforesaid. To secure the grippers (see Figures 25 and 26) to the chain belt, elongated holes 42 are pierced in the top 40[a] of the gripping members through which holes 42 projections 41[a] on the side plates 36 project a sufficient distance to allow of their being riveted over and thus secure the grippers to the chain belt.

As an alternative method of securing the gripping members A, B to the side plates (see Figures 27 and 28) projections 45, left on the side plates 36, instead of being riveted over may be made of a suitable shape and have holes punched or drilled to receive pins 46 which secure the gripping members to the side plates. The said pins have one side of their heads flattened and the ends split so that after assembling the parts together the said ends are opened and thus prevent the pins 46 from falling or jarring out of position.

Figures 29, 30 and 31 illustrate another application of my invention. Figure 29 is a cross sectional elevation. Figure 30 is a side elevation and Figure 31 is a plan of a portion of a chain belt illustrating a different method of construction from those hereinbefore described particularly on reference to the construction of the gripping members A, B and the side plates 36 to obtain a similar resilient action to that hereinbefore described.

The gripping members A, B are formed from sheet metal blanks with a parallel sided portion forming the top and an inclined sided portion forming the sides 45[a], 46[a] and ends 31, 32. The blanks are bent at or near the point of intersection of the parallel sides and the inclined sides and inclined inwardly. The ends 31, 32 are bent inwardly and curved to touch the outwardly curved end of the side plate 36, said gripping members having suitable rivet holes punched or drilled in the flat tops 33, 34 to secure same by riveting or other suitable means to the side plates 36 of the chain belt. The side plates (see Figure 29) are made in a different form from those herein previously described and are blanks stamped or pressed out of suitable sheet metal and of a suitable shape to allow of the top edge being bent outwardly to form a flange to receive the gripping member, said flange having holes provided to register with the holes in the gripping member and so allow of the insertion of rivets 43, 44, bolts or other suitable fastening. The bottom ends of the side plates 36, 36 are curved outwardly at 39 so as to touch and form a seating for the ends 31, 32 of the gripping members A, B. Rivet holes are provided at suitable centres in the flat sides of said side plates 36 to receive the rivets 37 or joint pins of the chain belt. Thus the sides 45[a], 46[a] form springs which are to a certain extent resilient as aforesaid and afford a perfect grip on the pulleys and are strengthened by the ends of the side plates being curved to form a bearing for the ends of the gripping members. Moreover, if desired in order to increase the frictional grip on the pulley flanges pads of leather, india rubber, or other suitable frictional material may be secured to the sides of the gripping members.

In the construction shown in Figures 32 and 33 an ordinary pitch chain 50 is provided with a member 51 and with inclined side links 52. The side links 52 are secured to the chain 50 by the ordinary rivets of the chain and each side link is bent outwardly as shown at 53 and inwardly as shown at 54 so that its end abuts against the part 51.

In the construction shown in Figures 34 and 35 each pair of converging grippers 55 are made in one piece. In these figures the grippers are shown as attached to a flat link 56 of a chain or flexible band but the grippers might equally well be applied to the link of a pitch chain of the roller, silent or other type. Those parts of the grippers 55 which are adjacent to the link 56 are provided with grooves or curves or corrugations as shown at 57 and the ends 58 abut against a plate 59 secured to the link 56 by rivets 60. The plate 59 is provided with a projection 61 at its centre for the purpose of receiving the ends 58 of the grippers 55. What may be termed the "apex" of the gripper 55 may be corrugated with one or a plurality of curves as shown at 62 or instead of the curves 62 being provided this part of the gripper may be made as shown in dotted lines in Figure 34.

In the construction shown in Figures 36 and 37 a combined pitch chain and belt is shown suitable for engagement with a pulley having more than one groove. The chain 63 may be of any suitable type and is provided with grippers 64 having inclined sides and being provided with a transverse portion 65 which is curved as shown at the centre of Figure 36 or which may be hinged as shown at 66 at the two end portions of Figure 36. If required portions of the grippers 65 may be hinged as indicated in dotted lines at 67 in Figure 36.

In the construction shown in Figures 38, 39 and 40 the grippers 68 are provided with a transverse corrugated portion 69 and the ends of the grippers are bent inwardly as shown at 70 and attached by rivets 71 to the link 72 of a belt or chain. It will be understood that where the grippers 68 engage with the rivets 71 the gripper is slotted so as to allow the gripper to have an inward

movement with respect to the rivets 71. The ends 73 of the gripper abut against each other so that the inclined sides are provided with a resilient backing. If required the corrugated portions 69 may be dispensed with and this portion made as shown in dotted lines in Figure 38.

In the construction shown in Figures 41 and 42 the grippers 74 may have abutting ends 75 or the two sides 74 may be made in one piece as shown in dotted lines at 76. That portion of the gripper 74 which is adjacent the chain or belt 77 is made integral with or secured to a pressure plate 78. The ends of these pressure plates 78 are turned downwardly as shown at 79 in Figure 42 and serve to tend to straighten the chain or belt after it leaves a pulley. The pressure plates 78 have a second function. When the driving element commences to pass around a pulley or sprocket, especially if the pulley or sprocket is a small one, as the driving element takes up the curvature of the pulley or sprocket the leading end 79 of each pressure plate 78 is displaced in relation to the link with which it is associated. This displacement of the pressure plates 78 forces a projecting portion 95 between the ends 96 of the grippers 74 and serves to expand the grippers, i. e. move them or tend to move them apart so as to form a good driving engagement with the sides of the pulley groove. In order to provide for this lateral movement of the grippers 74 they may be attached to the belt or chain 77 by rivets 97 having enlarged portions 98 which pass through elongated slots 99 in the grippers. Spring washers 100 may be provided between the heads of the pins 97 and the interior surfaces of the grippers 74 so as to permit of the inward movement of the pressure plates 78 together with the grippers 74. The centre parts of the grippers 74 at each end may be cut away to accommodate the ends 79 of the pressure plates 78.

If required the expansion of the grippers when the driving element is flexed may be obtained by providing extensions upon the grippers and dispensing with the pressure plates. In such an arrangement the extensions on the grippers engage with the underside of the next link of the chain or belt in the same manner that the ends 79 of the pressure plates 78 engage with the links.

In the construction shown in Figures 44, 45 and 46 the chain 101 is made up of cranked links as shown clearly in Figure 46 and the grippers 102 are secured to angle plates 103 carried by the side links of the chain. Formed integral with the chain 101 or formed separately are plates 104 having inclined ends 105 which serve as a resilient backing for the grippers 102. In this arrangement it should be known that each pair of grippers are attached to the chain at a single pivoting point 106 thus allowing the grippers to oscillate upon the chain if required. This arrangement could equally well be used with a belt or with a chain having flat links. In this arrangement the ends of the grippers are bent to a plurality of curves 107 producing the necessary resiliency.

In the construction shown in Figures 47, 48 and 49 the grippers 108 are made in one piece and secured to the underside of a chain composed of flat links by engaging over rods 109. In order to keep the grippers in place ears 110 are pressed out of the grippers and loosely engage with the rods 109. These grippers can easily be removed from the belt or chain by taking out the rods 109. This arrangement has the advantage that a certain limited bodily lateral movement is permitted to the grippers. This lateral movement is particularly useful when the driving element is running upon belts which are not accurately in alignment. As will be seen from Figure 47 the outer part of the grippers is bent to a plurality of curves as shown at 111 giving resiliency between the outer parts of the grippers as well as the resiliency obtained by the curved ends 112 at the inner parts of the grippers.

A similar form of the driving element is shown in Figure 63 wherein however, the ears 110 are dispensed with and distance tubes 113 are placed over the rods 109. Further, in this arrangement the bodily lateral movement of the gripper is restrained by a shoulder pin 114 carried by the belt or chain and engaging in a slot 115 in the gripper.

In the construction shown in Figures 50, 51 and 52 the arrangement shown is extremely similar to that shown in Figures 47, 48 and 49 but the chain is here provided with integral lugs 116 to accommodate the rods 109.

In the arrangement shown in Figures 53, 54 and 55 instead of using the lugs 116 for accommodating the pins 109 a special holder 120 is provided upon the underside of each link, which holder carries the pins 109.

With regard to the arrangement shown in Figures 50, 51, 52, 53, 54 and 55 it will be understood that the modifications described with reference to Figure 63 could be applied thereto.

In the construction described in Figures 56, 57 and 58 the outer side links 121 of a roller chain are made of angle section and serve to carry the grippers 122. In Figure 56 the grippers are shown hinged together at 123 but alternatively they might be made in one piece as indicated in dotted lines at 124. The inner links 125 of the chain are provided with inclined projections 126 which form resilient backings for the ends 127 of the grippers.

In the construction shown in Figure 59 the inclined sided grippers 80 at the portions remote from the chain or belt 81 may either be corrugated as is shown in similar parts of the other figures of the drawings, or the ends 82 may abut as shown. The sides 80 are provided with inwardly curved portions 83 which enable the upper parts of the sides 80 to move inwardly as well as the lower parts.

In the construction shown in Figure 60 the chain or belt 84 is provided with a carrier 85 which carries the inclined sided gripping members 86 which are slidably mounted therein. The inclined sided gripping members 86 may be resiliently supported by coiled or other springs such as 87. Instead of being slidably mounted in the plates 85 the gripping members may be secured at their upper ends to the chain or belt 84 and their lower ends may be free and abut against the carrier 85.

It will be understood that in any of the constructions herein described the inclined sides of the gripping members instead of being flat may be slightly convex to give additional resilience.

In the construction shown in Figure 61 the chain or belt 88 is provided with inclined sided gripping members 89 which are provided with a resilient backing by a spring 90 which passes through slots or holes at 91 near the ends or near the centre of the gripping members 89.

In the construction shown in Figure 62 the gripping members 92 may be attached to a chain or belt in any suitable manner and the gripping members 92 in addition to being provided with a curved resilient backing 93 of the kind already described may be provided with internal springs 94 carried by the chain or belt. The ends 95 of the grippers 92 are left free so that they can move together or apart under the influence of the springs 94 of the sides of the pulley.

In the construction shown in Figure 64 the larger part of the inclined grippers 128 is shown remote from a sprocket chain 129 whereby at one end the driving element may run upon a chain sprocket and at the other end may run upon a grooved pulley. The construction shown in Figure 64 incorporates a number of features which have already been described with reference to the other figures and which will be readily understood.

If required pads of resilient material, springs or spring washers may be inserted between the gripping plates and the side links or between the side links and distance pieces on the joint pins.

What I claim then is:—

1. A flexible driving element comprising a series of links; hinges uniting said links together, end to end, to form a flexible band; an inclined sided gripping member attached to each of said links adapted to engage frictionally with the sides of a pulley groove, said gripping members having portions extending transversely in the space between them, which portions are bent to a curve to make them resilient and operate to form a resilient backing for the inclined sides to resist the inward displacement of said sides.

2. A flexible driving element comprising a flexible band having a series of inclined sided gripping members adapted to engage frictionally with the sides of a pulley groove, said gripping members having inwardly bent portions to make them resilient said portions extending transversely in the space between them, which portions are bent to a curve to make them resilient and operate to form a resilient backing for the inclined sides to resist the inward displacement of said sides.

3. A flexible driving element comprising a flexible band having projections on one side, longitudinal rods carried by said projections, inclined sided gripping members mounted on said rods so as to be capable of bodily transverse movement in relation to the band and adapted to engage frictionally with the sides of a pulley groove, said gripping members having portions extending transversely in the space between them, which portions are bent to a curve to make them resilient and operate to form a resilient backing for the inclined sides to resist the inward displacement of said sides.

In witness whereof I affix my signature.

WALTER REUBEN KEEN.