

[54] **APPARATUS FOR APPLYING FINs TO
STATIONARILY HELD PIPES WITHOUT
SUBJECTING THE FINs TO VIBRATIONS**

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29/208 R

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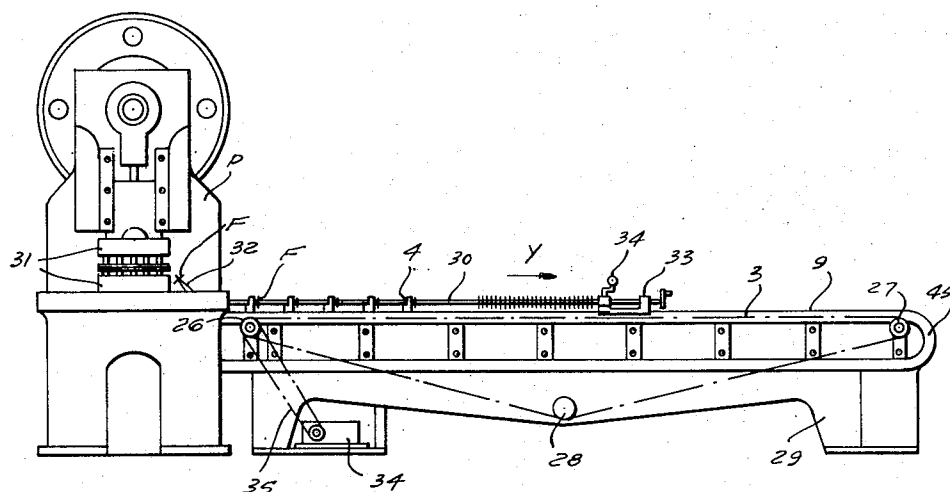
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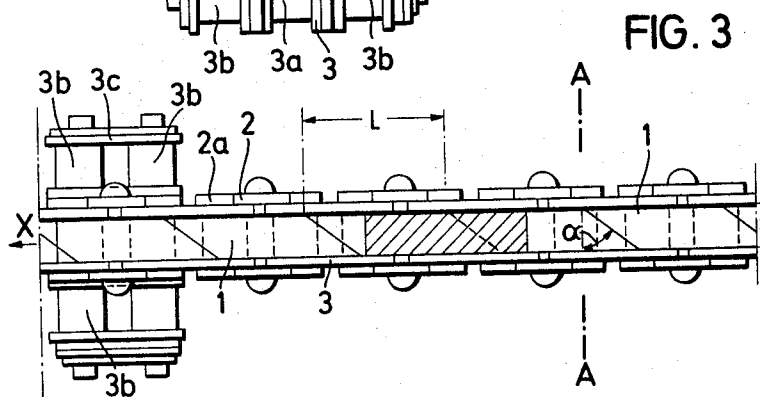
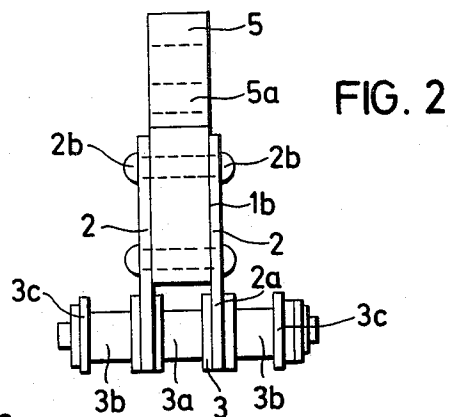
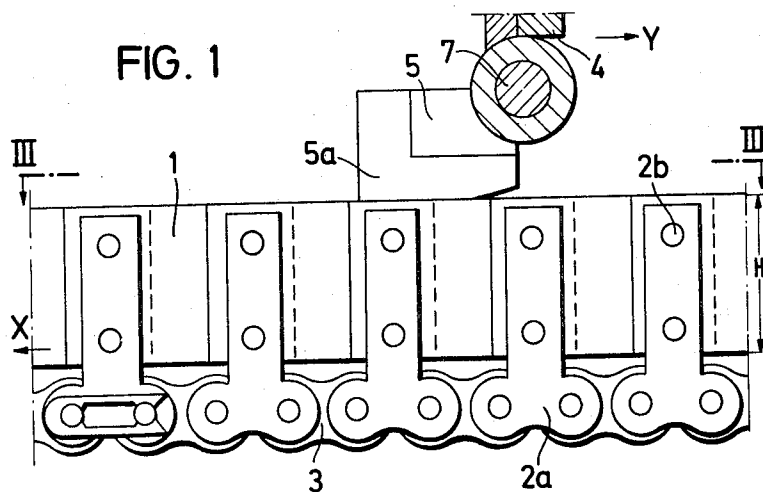
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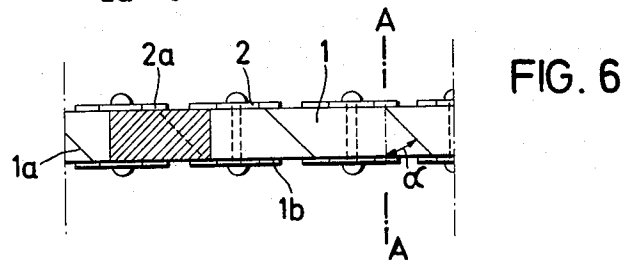
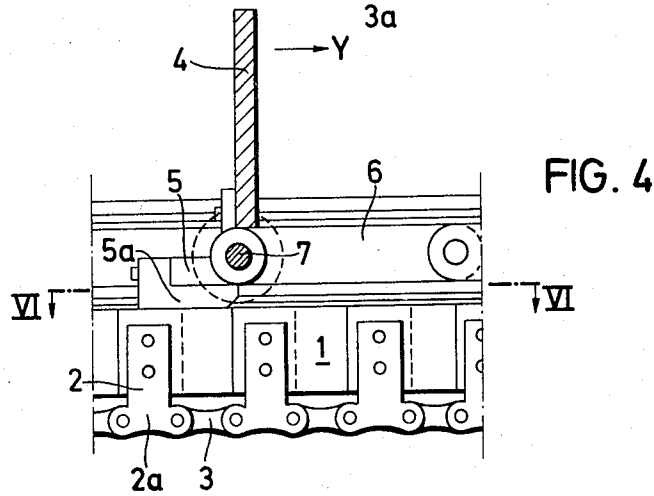
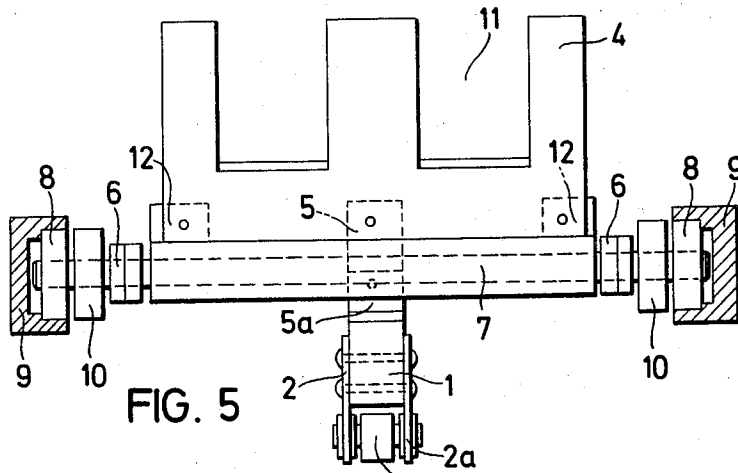
ABSTRACT

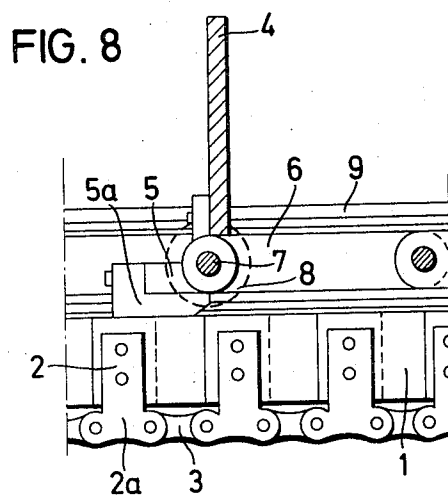
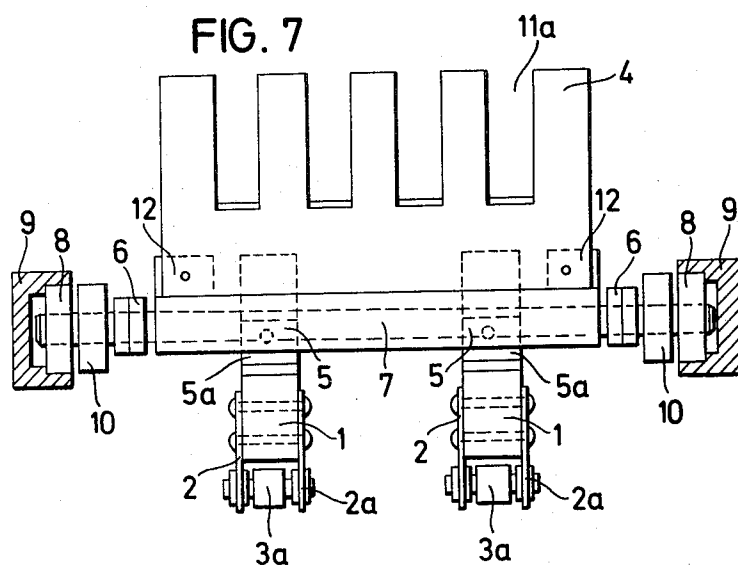
An apparatus for applying fins onto pipes held stationarily on one of the ends thereof. The fins are pushed seriatim onto the pipes from the free opposite ends by means of a plurality of spaced substantially parallel plate-shaped entrainment members moved by endless transporting means, the working runs of which move substantially parallel to the pipes from the free toward and beyond the fastened ends of the latter. Each of the entrainment members is tiltable between a working position extending substantially normal to the pipes and a releasing position. Each of the entrainment members is provided with at least one glide shoe which abuts on a respective one of a plurality of support members attached to and closely arranged along part of an endless chain, the working run of which is moved in a direction opposite to that of the transporting means. The support members are arranged and constructed so that the glide shoe on each entrainment member before leaving one support member engages already the next support member so that the glide shoes on the entrainment members and therewith the latter are not subjected to vibrations while they push the fins onto the pipes, whereby the fins are applied to the pipes in vibration free manner.

14 Claims, 9 Drawing Figures









APPARATUS FOR APPLYING FINS TO STATIONARILY HELD PIPES WITHOUT SUBJECTING THE FINS TO VIBRATIONS

BACKGROUND OF THE INVENTION

The present invention relates to an apparatus for applying fins to stationarily held pipes by means of endless transporting means which carries a plurality of entrainment members spaced from each other in longitudinal direction of the transporting means. Each of the entrainment members is tiltable between a working position extending substantially normal to the axes of the pipes and a releasing position, and the entrainment members are held in the working position by means of glide shoes provided thereon which engage, during the time the entrainment members are to be held in their working position, upper guide faces of a plurality of support members mounted closely adjacent to each other on an endless support chain over part of the length of the latter and in which the working run of this support chain is moved parallel and in opposite direction to the working run of the endless transport means. The end faces of adjacent support members on the support chain facing each other are preferably arranged substantially normal to the guide faces thereof and arranged closely adjacent to each other.

In a known apparatus of this type, the facing end faces of the support members which are arranged normal to their upper guide faces are also arranged in parallel planes which are normal to the direction of movement of the support chain. Experience has shown that, during extended use, the upper edges of the facing end faces of the support members are subjected to a relatively great wear so that the upper edges are more or less obliterated by the slide shoes of the entrainment members. This is due to the fact that the glide shoe of each entrainment member will engage, over its whole width transverse to the direction of its movement, after leaving the trailing edge of one support member, the facing end edge of the next following support member so that the leading edge thereof is subjected to considerable mechanical stresses. This detrimental effect is increased due to the fact that the chain carrying the support members will, during extended use, be slightly elongated, so that the originally minute gap between successive support members will be increased. The glide shoes on the entrainment members will during their advance movement partly penetrate into the gap and will with increasing wear of the end edges of the support members impinge with an increasing impact on the edges so that the wear of the latter will rapidly increase during extended use of the apparatus. This will also result in an increased wear of the trailing edges of the support members. The penetration of the glide shoes in the gaps between the facing end faces of successive support members will lead to an uneven movement of the entrainment members which will have detrimental effects especially if rather long pipes are to be supplied with fins. The fins advanced by the entrainment members are thereby subjected in a detrimental manner to blow-like impacts which may cause vibration of the fins. The shocks imparted by the entrainment members to the fins may also lead to an undesired widening of the collars of the fin, usually provided about the central opening thereof, so that the fins will not any longer resiliently engage the pipes onto which

they are placed. This will result in that the fins, after being placed on the pipes, may move in an undesirable manner in longitudinal direction thereof in which case spacer means must be provided between the fins, which in turn increases the cost of the arrangement.

SUMMARY OF THE INVENTION

It is an object of the present invention to overcome the above-pointed out disadvantages of apparatus known in the art for applying fins to pipes.

More specifically, it is an object of the present invention to provide for such an apparatus in which wear on the mentioned components of the apparatus is considerably reduced.

In order to obtain the desired results, the facing end faces of the support members in the apparatus according to the present invention are at least over an essential part of the width of the support members, preferably over their whole width, arranged in planes which deviate from planes extending normal to the direction of movement of the support chain carrying the support members. The facing end faces of the support members are preferably arranged under an acute angle to planes which extend normal to the direction of movement of the support chain.

Such an arrangement will assure that during advance of the entrainment members each glide shoe thereon will during its transition from one to the following support member, be in contact with the upper guide faces of two successive support members so that the glide shoe cannot partially enter into the gap between facing end faces of two successive support members. The wear of the facing upper end edges of adjacent support members is thereby reduced to a fraction of the wear encountered in the above-described apparatus known in the art, so that the support members will have a much greater useful life than could be formerly obtained. The specific construction of the support members will also result in a much smoother movement of the entrainment members so that the fins pushed by the same on the pipes will not be subjected to any jolts. Therefore, vibration of the fins during application to the pipes is avoided and so is an enlargement of the fin collars. Furthermore, the fins will, even after being pushed by the apparatus according to the present invention to their proper places on rather long pipes, for instance pipes of a length of 10 to 12 meters, sit tightly on the pipes due to the resilient action of the fin collars so that the necessity of providing spacer means between successive fins for maintaining the desired distance therebetween becomes unnecessary.

Advantageously, the acute angle between the facing end faces of the support members and planes which extend normal to the direction of movement of the support chain are held for all support members of a support chain of equal size. This has the advantage that the same conditions will be obtained for all support members during the movement of the glide shoe over the gaps between successive support members. Since the support members on the support chain are, with the exception of the first and the last support member of the plurality of support members of the chain, preferably of the same length, all support members on the chain with the exception of the first and last one may be of exactly identical construction. Preferably, the support members, with the exception of the first and

last one, are constructed so that the top views thereof will be substantially in the form of a parallelogram.

In order to reduce the wear of the facing end faces of the successive support members and to assure a smooth movement of the entrainment members, it is advantageous to maintain the acute angle between the facing end faces of the support members and planes which extend normal to the direction of movement of the support chain at about 30 to 70°. Especially advantageous conditions are obtained when the aforementioned angle is about 40-60°.

The chain carrying the support members is preferably constructed as a sprocket chain and every second link or side plate of this chain is preferably provided with an integral upwardly extending projection to which the side-faces of the respective support member are connected by rivets or by welding. This leads to a very compact construction which can be produced at reasonable cost, and besides, since in such a construction the upwardly extending projections will be exactly aligned in transverse direction of the chain, any canting of the support members connected thereto will be prevented, and the drive of the chain by sprocket wheels will not be hampered in any way.

Advantageously, the support members are made from wear-resistant steel or surface-hardened steel. This in turn will further increase the useful life of the support members as compared with support members constructed from structural steel as previously used in apparatus of this type.

In known apparatus of this type, the last supporting member, as considered in the direction of movement of the support chain, has a length which is about twice the length of the other support members. According to the present invention it is suggested that the length of the last-mentioned support member is about 6 to 8 times greater than the length of the other supporting members. This has the advantage that the glide shoes of the entrainment members during the last part of their movement at which they apply fins to the pipes will not pass any longer any gap between successive support members so that especially during the last part of the active movement of the entrainment members a very smooth movement of the same is obtained so that the fins pushed by the entrainment members onto the pipes will be released from the entrainment members at exact predetermined positions and so that even at an operating speed in which for instance 350 to 450 fins per minute are applied to the pipes, a very exact spacing between successive fins can be obtained.

A further improvement over such apparatus known in the art is obtained, especially in an apparatus to be used for simultaneously applying fins to a plurality of pipes which are arranged adjacent to each other in a horizontal plane, by providing each entrainment member with at least two laterally displaced glide shoes of substantially identical construction which are guided on a corresponding number of laterally spaced parallel support chains. For the simultaneous application of ribs onto 4-7 pipes arranged adjacent to each other, it is usually sufficient to provide two glide shoes on each entrainment member which cooperate with two parallel laterally spaced support chains of substantially identical construction. In this way the forces applied by the glide shoes onto the support members on the support chains may be held considerably smaller than in constructions in which each of the entrainment members

has only a single glide shoe cooperating with the support members on a single support chain so that, by the above-mentioned arrangement according to the present invention the wear on the support members and the glide shoes may be further reduced.

The parallelly arranged support chains are synchronously driven and so adjusted that the support members thereon which constitute the last support members in the direction of movement of the chains will simultaneously release all glide shoes of a respective entrainment member. This will assure that when each entrainment member has at least two or more glide shoes, which are guided on a corresponding number of parallelly arranged support chains, the fins on all adjacently arranged pipes will be simultaneously released at the exact same position on each pipe so that also in this case an exact distance of successive fins on the plurality of pipes may be obtained, even if the apparatus is operated at high speed.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial side view of the apparatus according to the present invention;

FIG. 2 is an end view of the elements shown in FIG. 1;

FIG. 3 is a cross section taken along the line III-III of FIG. 1;

FIG. 4 is a partial side view of a second embodiment according to the present invention;

FIG. 5 is an end view of the elements shown in FIG. 4;

FIG. 6 is a cross section taken along the line VI-VI of FIG. 4;

FIG. 7 is a partial end view of a third embodiment;

FIG. 8 is a partial side view of the elements shown in FIG. 7; and

FIG. 9 is a schematic overall side view of the apparatus according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawing, and more particularly to FIG. 9 of the same, it will be seen that the apparatus according to the present invention for applying fins to stationary pipes may comprise support means 29, shown in FIG. 9 as an elongated bench, at one end of which, shown in FIG. 9 as the left end, a punch press P is arranged. Die means 31 are mounted on the punch press P for punching out fins F, in a known manner not forming part of the present invention, from a sheet metal fed into the press. The fins F punched out by the die means are fed seriatim by feeding means of known construction, not illustrated in the drawing, onto horns 32 mounted on the left free ends of the plurality of pipes 30, the right ends of which, as viewed in FIG. 9, are fixedly held in a stationary position substantially parallel to the upper surface of the bench 29 by holding means 33. The holding means 33 are provided with

manually operable clamping means 34 in which the right ends of the pipes 30 are respectively clamped. The bench 29 carries on its upper face a pair of transversely spaced guide rails 9 of substantially U-shaped cross section, as will be described later on in detail, and each having an upper portion and a lower portion connected by semi-circular connecting portions 45, only the right one of which is shown in FIG. 9, whereas the left one is hidden by the press P. The fins F fed onto the horns 32 are pushed onto the pipe up to the desired location by entrainment members 4 carried spaced from each other by endless entrainment means guided, as will be described later on in detail, in the aforementioned guide rails 9 so that the upper run of the endless entrainment means moves in the direction of the arrow Y shown in FIG. 9. Each of the entrainment members is mounted on the endless transporting means, in the manner as will be described later on in detail, being tiltable from an active position in which the entrainment member 4 extends substantially normal to the axes of the pipes so as to push the respective fin or fins up to the desired location on the stationarily held pipes, and a releasing position releasing the engaged fin so that, as the entrainment member moves further in the direction y, the respective fin or fins will be disengaged from the entrainment member and remain stationarily at the desired position on the pipe or pipes. Each of the entrainment members 4 is provided with at least one glide shoe 5, as will be described later on in detail, which cooperates with support members 1 on an endless support chain 3 to maintain the respective entrainment member 4 in its active position until its glide shoe becomes disengaged from the last support member on the supporting chain, whereafter the entrainment member will tilt to its releasing position. The support chain or chains 3 are mounted on rollers or sprocket wheels 26, 27 and 28 as indicated in FIG. 9 so that the upper run of the support chain moves parallel to the axes of the pipes 30. The support chain or chains 3 may be driven from a motor 34 over a belt drive or the like 35 so that the upper run thereof moves in direction opposite to the direction as indicated by the arrow y. The support members 1 are mounted on the support chain or chains 3 only over part of the length of the chain or chains in a manner as will be described later on in detail. The roller 28 may be mounted movably in transverse direction to the chain or chains so that the latter may be appropriately tightened in a known manner.

Referring now to FIGS. 1-3 in which the support members 1 and the mounting thereof on the support chain are illustrated in further detail, it will be seen that each of the support members 1 has a pair of parallel side faces 1b which extend parallel to the direction of movement, indicated by the arrow x, of the supporting chain, whereas the facing end faces 1a of adjacent support members extend substantially normal to the upper guide faces thereof and at an angle α of about 40 to 60° to a plane indicated at A-A in FIG. 3 which extends normal to the direction x. The width B of each support member 1 is about 20-25 millimeters, whereas its height H is considerably greater than this width.

Side plates 2 aligned in transverse direction are connected by rivets 2b to opposite side faces 1b of each support member 1. The side plates extend substantially over the whole height H of the respective support member. The lower ends 2a of the side plates 2 are constructed as links of a sprocket chain 3 which is arranged

beneath the support members 1. Each second link of the sprocket chain 3 is formed by the lower end 2a of the side plates 2 so that the length L of each support member, with the exception of the first and the last support member connected to the chain 3, is equal to the length of two links of the sprocket chain. The links of the sprocket chain are connected by bolts on which rollers 3a are freely turnably mounted, which latter are adapted to be engaged by teeth of a sprocket wheel, for instance the sprocket wheel 26 shown in FIG. 9, so that the chain 3 may be driven in the direction as indicated by arrow x.

As shown in FIGS. 1-3, the aforementioned connecting bolts of the sprocket chain 3 are laterally extended to opposite sides of the chain at least at one link of the latter and the extended bolts carry guide rollers 3b as well as connecting plates 3c. The guide rollers 3b are guided in an appropriate guide, not shown in the drawing. In this way, the chain is prevented from tilting in transverse direction.

The entrainment members 4 carried by the endless transporting means 6 are slidably guided by means of glide shoes 5 on the upper guide faces of a plurality of adjacent support members 1. The entrainment members 4 are, as mentioned before, carried spaced from each other on the endless transporting means 6, the upper working run of which extends parallel to the axes of the pipes and this upper working run of the endless transporting means is moved in the direction as indicated by the arrow y. Each of the entrainment members is connected to the endless transporting means constituted by a pair of parallel endless sprocket chains 6 tiltable in a direction normal to the advancing direction y about the axes of horizontally arranged bolts 7. The bolts 7 serve at the same time as connecting bolts for the links of the sprocket chains 6 and they carry at the outer ends thereof rollers 8 which are guided in the guide rails 9 of U-shaped cross section. The bolts 7 further carry, inwardly of the guide rolls 8, transport rollers 10 turnably mounted thereon and being adapted to be engaged by driven sprocket wheels, not shown in the drawing, to drive the chains 6 carrying the entrainment members 4 in the direction as indicated by the arrow y.

In the embodiments illustrated in FIGS. 1-6, the entrainment members 4 are provided in the upper region thereof with two cutouts 11 through which the pipes 30 to which the fins F are to be applied will respectively extend. In the embodiment illustrated in FIGS. 7 and 8, the entrainment members 4 are provided in the upper region thereof with four cutouts 11a so that with this embodiment four pipes arranged adjacent to each other may simultaneously be provided with fins, whereas the embodiment shown in FIGS. 1-6 is constructed for simultaneously applying fins to two adjacently arranged pipes.

The cutouts 11 and 11a of the entrainment members 4 have a transverse width which is greater than the outer diameters of the pipes to be provided with fins, but smaller than the transverse dimensions of these fins. The pipes may be provided with separate fins, or with fins which extend in transverse direction over a plurality of pipes so that the fins will at the same time connect adjacent pipes to each other.

A sleeve freely turnably mounted on each bolt 7 is provided at the outer end with a pair of radially extending lugs 12 to which the respective entrainment mem-

ber 4 is connected by screws or the like. In the embodiment shown in FIGS. 1-6 a glide shoe 5 is connected in a similar manner to the sleeve substantially midway between the two lugs 12. The glide shoe 5 is located beneath the axis of the bolt 7 and projects essentially in a direction opposite to the advancing direction of the entrainment member 4, as indicated by the arrow y, and is provided at its lower side with a glide member 5a formed from wear resistant steel. Due to this construction, each of the entrainment members 4 is subjected to a turning moment tending to tilt the entrainment member in a direction opposite to the advancing direction y as a result of engagement of the entrainment member with the respective fin.

In the embodiment as illustrated in FIGS. 7 and 8, two glide shoes 5 are arranged between the lugs 12 and symmetrically with respect to a plane of symmetry of the respective entrainment member. The slide shoes 5 shown in FIGS. 7 and 8 are substantially of the same construction as that shown in the embodiment of FIGS. 1-6.

In the embodiment illustrated in FIGS. 1-6 a single support chain is provided on which the glide shoes 5 of the entrainment members are guided. In the embodiment according to FIGS. 7 and 8 there are provided two parallel laterally displaced support chains of the same construction on which the two glide shoes on each entrainment member are slidably guided. The width of the glide shoes in both embodiments correspond substantially to the width B of the support members 1. The above-described apparatus will operate as follows:

A plurality of pipes 30 are held in stationary position extending parallel to each other and parallel to the upper portion of the guide rails 9, by the holding means 33. The press P is started and simultaneously, the drive for the endless transporting means 6 as well as the drive for the support chain or chains 3 are started, whereby the endless transporting means 6 carrying the entrainment members 4 will move in the direction indicated by the arrow y whereas the support chain or chains 3 carrying the support members 1 moves or move in the opposite direction as indicated by the arrow x. The upper run of each support chain 3 has to have a length at least equal to the length of the pipes, and, as mentioned before, only part of the support chain, i.e. about half of the length thereof, is provided with support members 1. The position of the support chain is adjusted at the start of the operation in such a manner that the last support member 1 thereof, that is the support member which trails in direction of movement of the support chain 3, is properly located. The fins F fed seriatim onto the horns 32 are thus pushed by the entrainment members 4 along the pipes while the glide shoes on the entrainment members slide on the upper faces of the support members 1 to thereby hold the entrainment members in their active positions extending substantially normal to the axes of the pipes until, during relative movement of the sprocket chains 6 and 3 in opposite directions, the entrainment member 4 leading in the direction of movement indicated by the arrow y passes the trailing edge of the last support member 1, so that the respective entrainment member will tilt from its active to its releasing position to become disengaged from the respective fin F so that the latter remains in stationary position on the pipe while the entrainment member in its releasing position moves past

the released fin. The entrainment members 4 are moved back from their releasing to their active position by means not forming part of the present invention and described in the co-pending application Ser. No. 278,616, as the portion of the endless transporting means carrying the respective entrainment member moves from the lower run back to the upper run.

Since the glide shoes 5 of the entrainment members while being guided on the upper guide faces of the support members 1 will, when passing from one to the adjacent support member, always be in engagement with the upper guide face of two adjacent supporting members, vibration of the glide shoes 5 and corresponding vibration of the entrainment member 4 will be positively avoided so that the fins will be applied to the pipes without being subjected to any vibrations.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of apparatus for applying fins to stationarily held pipes differing from the types described above.

While the invention has been illustrated and described as embodied in apparatus for applying fins to stationarily held pipes without subjecting the fins to vibrations, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art fairly constitute essential characteristics of the generic or specific aspects of this invention and therefore such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. In an apparatus for applying fins to pipes held stationarily in the region of one of the ends, in which the fins are pushed seriatim from the opposite ends of the pipes onto the latter by means of a plurality of spaced substantially parallel plate-shaped entrainment members moved by endless transporting means having a working run movable substantially parallel to the direction of the pipes from the opposite ends thereof toward and beyond the one end, and in which each of the entrainment members is connected to said transporting means tiltably about a tilting axis between a working position extending substantially normal to the axes of the pipes and a releasing position, a combination comprising at least one glide shoe fixed to each of said entrainment members; and support means engaged by the glide shoe of each entrainment member for maintaining the latter in said working position until the entrainment member has transported a fin to a proper location on the pipe and for thereafter permitting the entrainment member to tilt about said tilting axis to its releasing position, said support means comprising at least one endless chain having a working run extending substantially parallel to that of said endless transporting means and moving in a direction opposite thereto, said chain carrying over part of its length a plurality of support members arranged in a row and having guide faces adapted to engage said glide shoes for holding the entrainment members in said working position, each of said support

members having a pair of end faces extending transversely to said guide face, the facing end faces of adjacent support members being closely spaced from each other and deviating at least over part of the width thereof from planes which extend normal to the direction of movement of said chain.

2. A combination as defined in claim 1, wherein said end faces deviate over the whole width thereof from said planes.

3. A combination as defined in claim 1, wherein said facing end faces extend at acute angles to said planes.

4. A combination as defined in claim 3, wherein said acute angles of said facing end faces on all support members have equal size.

5. A combination as defined in claim 3, wherein said guide face of each support member with the exception of those at opposite ends of said row has the shape of a parallelogram.

6. A combination as defined in claim 3, wherein said acute angles are between 30-70°.

7. A combination as defined in claim 3, wherein said acute angles are between 40-60°.

8. A combination as defined in claim 1, wherein said chain is arranged beneath said support members, wherein each of said support members has a pair of substantially parallel side faces extending between said end faces, and including for each support member a pair of side plates attached exactly opposite each other to said side faces and each having a lower end constructed to form a link of said chain.

9. A combination as defined in claim 1, wherein at least that part of each of said support members which includes said guideface is made of steel.

10. A combination as defined in claim 1, wherein the

length of one support member at the end of the row which trails in the direction of movement of said chain exceeds the lengths of the other support members.

11. A combination as defined in claim 10, wherein the length of said one support member is 6-8 times the length of the other support members.

12. A combination as defined in claim 1, wherein each of said entrainment members serves to push fins over a plurality of pipes which are arranged parallel and adjacent to each other, each of said entrainment members having at least two glide shoes attached thereto laterally spaced from each other and of substantially the same construction, said support means comprising parallel chains equal in number to that of the slide shoes on each entrainment member and each carrying over a part of equal length a plurality of said support members having guide faces adapted to engage said glide shoes.

13. A combination as defined in claim 12, wherein said parallel chains are synchronously driven and wherein the trailing ends of the guide faces of the trailing end of the rows of support members are arranged to become disengaged from the slide shoes of the respective entrainment member exactly at the same time.

14. A combination as defined in claim 1 wherein each of said entrainment members is tiltable about a tilting axis which extends substantially normal to the direction of movement of said transporting means and wherein said at least one slide shoe for each entrainment member is attached in the region of said tilting axis to the respective entrainment member and trailing in the direction of movement of said working run of said transporting means.

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