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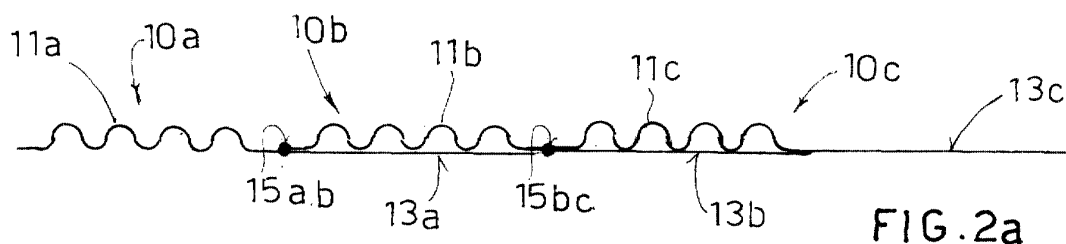
(54) **Gas-tight flexible welded pipe, apparatus for making same and manufacturing process**

(57) A gas-tight tube is formed starting from a strip of partially corrugated sheet metal with longitudinal corrugations, assembled in a spiral with overlapping edges and welded.

The manufacturing process comprises winding the sheet metal strip upon itself in a spiral so that a corrugated portion of a strip length externally overlaps a flat

portion of a previously wound strip length, and welding the overlapping portions to each other.

The apparatus comprises a feeding device for feeding the corrugated strip, to a rotating mandrel with which pressure rollers collaborate to bend the strip in a spiral; downstream of the mandrel it comprises a welding device that welds the overlapping portions of the spiral of metal strip.



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Description

[0001] The invention refers to pipes, particularly for flue gases.

[0002] Known to the art and widely used are corrugated tubes or pipes for emission of flue gases, consisting of a completely corrugated strip with corrugations or undulations having a longitudinal axis, said strip being spirally wound, contacting edges of strip portions being coupled to each other by seaming.

[0003] Although this type of pipe has been widely used up to now, with the coming into force of more restrictive safety standards it will no longer be possible to use such pipes, in that they are not sufficiently gas-tight.

[0004] The object of the present invention is to obtain corrugated pipes that have an excellent gas-tight seal, but that can nevertheless be produced at an economically advantageous cost.

[0005] These objects have been achieved with a pipe as stated in claim 1, a process as stated in claim 11 and an apparatus as stated in claim 3.

[0006] The new pipe is composed of a metal strip with an at least partially corrugated profile, said strip being wound in a spiral with overlapping edges, the overlapping edges being welded. The metal strip preferably has a profile that comprises a corrugated portion with undulations or corrugations having their axis longitudinal to the strip and an adjacent flat or smooth portion, and the tube is assembled so that the corrugated portion of a length of strip is outwardly overlapping with respect to the smooth portion of an adjacent length of the strip. The overlapping portions of strip are welded to each other by any per se known welding method.

[0007] The apparatus essentially comprises feeding means to feed to a mandrel an at least partially corrugated metal strip having corrugations lying longitudinally; a mandrel rotatable around an axis substantially transversal to a feeding direction of the strip, to wind the strip in a spiral, radial pressure wheels or rollers that press the strip on the mandrel. Just downstream of the mandrel a welding device welds the overlapping edges of the spiral strip.

[0008] The invention fulfils the above mentioned objectives, in particular the pipe has good gas-tightness, and does not obstruct the flow of flue gases internally, though being flexible and strong.

[0009] An embodiment of the invention will be described below purely by way of an exemplary unrestricted embodiment with reference to the appended figures, in which:

Figure 1 shows a side view of a length of pipe according to the invention;

Figure 2 shows, in cross sectional view, a strip of corrugated sheet metal used to form the pipe of the invention;

Figure 2a is a longitudinal sectional view taken along the pipe, showing a part of a pipe wall, en-

larged with respect to Figure 1, to show better the overlapping of the coils of sheet metal of which it is composed;

Figure 3 is an elevational sectional view taken along plane 3-3 in Figure 5 of an apparatus according to the invention, reduced in scale;

Figure 4 is a top plan view with respect to Figure 3; Figure 5 is a left elevational side view of the apparatus of Figure 3;

Figure 6 is an enlarged broken-away part-sectional view taken along plane 6-6 in Figure 3.

[0010] With reference to the figures, a pipe or tube T shown in Figure 1, in accordance with the invention, is composed of a strip of sheet metal wound in a spiral. The sheet metal strip used can be better seen in Figure 2 and is indicated by reference numeral 10. Indicatively, sheets 0.08 to 0.20 mm thick are used. The strip comprises a portion 11 with longitudinal corrugations or undulations 12 having their axes parallel to each other and lying longitudinally to the strip, and a substantially flat portion 13. The strip 10 is wound on itself in a spiral so that the corrugated portion 11 of each strip section is disposed externally to the adjacent flat strip portion 13, as can be seen in Figure 2a. For the sake of clarity in Figure 2a a first strip section or length referenced 10a, a second strip section or length referenced 10b and a third strip section or length referenced 10c are shown. The strip section 10a has a flat or smooth portion 13a on which a corrugated portion 11b of strip section or loop 10b is superimposed, or better is externally disposed; a flat portion 13b of the loop or strip section 10b is covered by the corrugated portion 11c of loop or strip section 10c. The overlapping edges of the strip loops are welded to one another, along a spiral line, visible as dots in Figure 2a. In said figure, for example, the loops 10a and 10b are welded to one another in position 15ab, the loops 10b, 10c are welded to each other in position 15bc; in this manner the pipe keeps some advantageous characteristics of corrugated tubes, such as flexibility, and yet has an excellent gas-tight seal, and, having the inside practically smooth, does not obstruct the outflow of the gases.

[0011] An apparatus according to the invention will be described with reference to Figures 3 to 6. The apparatus, indicated as a whole by reference numeral 20, comprises an unwinding reel 22, which carries a coil 24 of sheet metal strip 26, preferably a sheet of stainless steel. Downstream of the reel, on a structure 27, the apparatus comprises a per se-known corrugating device referenced 28 as a whole, which will not be described here in detail. The corrugating device is such as to give the strip 26 a corrugation with undulations having their axis longitudinal to said strip on at least one portion of the width of the strip 26. The undulated or corrugated metal strip 30 leaving the corrugator is preferably the strip 10 and travels in the direction of the arrow FN and according to axis b. Reference numeral 29 denotes a

control panel.

[0012] A winding mandrel is referenced 32 and is rotatable around an axis a substantially perpendicular to the sheet of the drawing in Figure 3.

[0013] The structure 27, as seen in a plan view, is mounted with feed means arranged to feed the strip 30 according to the axis b substantially transversal to the axis a, but with an inclination with respect to a perpendicular to the axis a, so as to generate the spiral. Generally an angle α between the axes a and b is between 90° and 115°, preferably 100°. Moreover, the structure 27 can preferably be mounted so that the arrangement thereof on the horizontal plane can be slightly varied, to vary the inclination of the axis b and the angle of the spiral. Reference 31 is a geared motor to effect said variation.

[0014] The mandrel 32 (Figure 6) is mounted integral with a mandrel-bearing sleeve 34 supported on bearings 36, the outer ring of the bearings is borne by a frame 38 of the apparatus. A rotational movement is given to the sleeve 34 by a motor 40, essentially through an output shaft 42 of the motor, pulleys 44, belts 46, and a pulley 48 integral with the mandrel-bearing sleeve.

[0015] Radial pressers or pushers 50 collaborate with the mandrel 32, said pressers preferably being disposed angularly equidistant around the mandrel, in stationary positions, and pressed radially against the mandrel. Each presser 50 substantially comprises a pressure wheel 52 idle around a spindle 53, the wheel 52 having a completely or partially corrugated profile indicated by 54. The collaboration of the mandrel 32 and the wheels 54 bends the strip 10 winding it on itself in a spiral and making it travel towards the left in Figure 3 (arrow FT), in the form of a pipe with an external corrugation.

[0016] Just downstream of the mandrel-presser assembly a welding assembly is disposed, indicated as a whole by 60. The welding assembly 60 comprises a welding head 62, preferably a per se known high frequency welding head, with variable frequency. A contrast means 64 is supported to project inside the pipe as it forms and is supported integral to a tube-shaped arm 66 resting on bearings 68 inside the sleeve 34, so that the arm or tube 66 can be held still on rotation of the sleeve. Inside the tube 66 ducts 70 for inert gas extend, said gas being fed into the welding area or immediately downstream thereof, to keep the product white and not oxidized.

[0017] Downstream of the welding group, a per se known brushing assembly can be provided to eliminate any oxides that have formed.

[0018] The process will now be described with reference to the figure.

[0019] A metal strip, preferably a stainless steel strip, is uncoiled from a reel and fed through the corrugating device, where it is corrugated generally on a portion thereof, generally half of its width. The partially corrugated metal strip is then wound in a spiral on itself by means of the mandrel and the presser means around

said mandrel, so as to superimpose the corrugated portion of each loop or ring of strip on the flat portion of an adjacent loop of strip. A weld is then made at the overlapping edges; the weld generally fastens together an extreme edge of the corrugated portion of the strip of a trailing loop on an intermediate edge of the smooth strip portion of a leading loop.

10 Claims

1. A pipe for conveying gases characterized in that it is composed of a metal strip wound in a spiral, the metal strip comprising at least one corrugated portion (1), adjacent loops or rings of the spiral being partially overlapped and welded.
2. A pipe according to claim 1, in which said strip comprises said corrugated portion having corrugations with their axis longitudinal to the strip, and a flat portion (13) alongside, the corrugated portion of a spiral loop or ring is disposed outside and superimposed on the flat portion of an adjacent loop, and the weld is substantially along a continuous spiral line.
3. An apparatus for forming a pipe according to claim 1, characterized in that it comprises:
 - feed means for feeding an at least partially corrugated metal strip (10, 30) having corrugations with their axis longitudinal to the strip,
 - rotating winding means to wind said strip in a spiral with the edges of the spiral partially overlapping
 - welding means (60) for making a weld on the overlapping edges of the spiral.
4. An apparatus according to claim 3, characterized in that the winding means for winding the strip (10) in a spiral to form the pipe comprise mandrel means (32) rotating around an axis (a) which is substantially transversal to a strip feeding direction.
5. An apparatus according to claim 4, characterized in that it comprises radial presser means (50), collaborating with the mandrel, and the presser means comprise idler wheels with a profile that is at least partially undulated or corrugated circumferentially.
6. An apparatus according to claim 3, characterized in that the welding means comprise a high frequency welding head, with variable frequency.
7. An apparatus according to claim 6, characterized in that the welding means comprise contrast means (64) inside the pipe, said contrast means being supported by an arm inside the mandrel but being in-

dependent from rotation thereof.

8. An apparatus according to claim 7, characterized in that it comprises ducts (70) for feeding inert gas inside the pipe. 5
9. An apparatus according to claim 3, characterized in that it further comprises corrugating means (28) upstream of the winding means, to produce at least partially corrugated strip with longitudinal corrugations starting from a flat strip. 10
10. An apparatus according to claim 9, characterized in that it comprises an unwinding reel (22) for unwinding flat strip, upstream of said corrugating means. 15
11. A process for producing gas-tight pipe starting from an at least partially undulated or corrugated metal strip, characterized in that it comprises the following steps: 20
- feeding a corrugated strip with corrugations having their axis longitudinal to the strip on at least part of its width, to a winding means winding said strip in a spiral with edges of adjacent spiral loops overlapping 25
- welding said overlapping edges to one another.
12. A process according to claim 11 characterized in that it comprises, upstream of said steps, the step of obtaining partially corrugated strip starting from a flat strip, the corrugations lying longitudinally and covering a partial surface in the width of said strip. 30
13. A process according to claim 11, characterized in that said weld is a high frequency weld with variable frequency. 35
14. A process according to claim 11, characterized in that it comprises the operation of feeding inert gas inside the pipe being formed during said welding step. 40
15. A process according to claim 11, characterized in that it comprises a brushing step downstream of the welding step. 45

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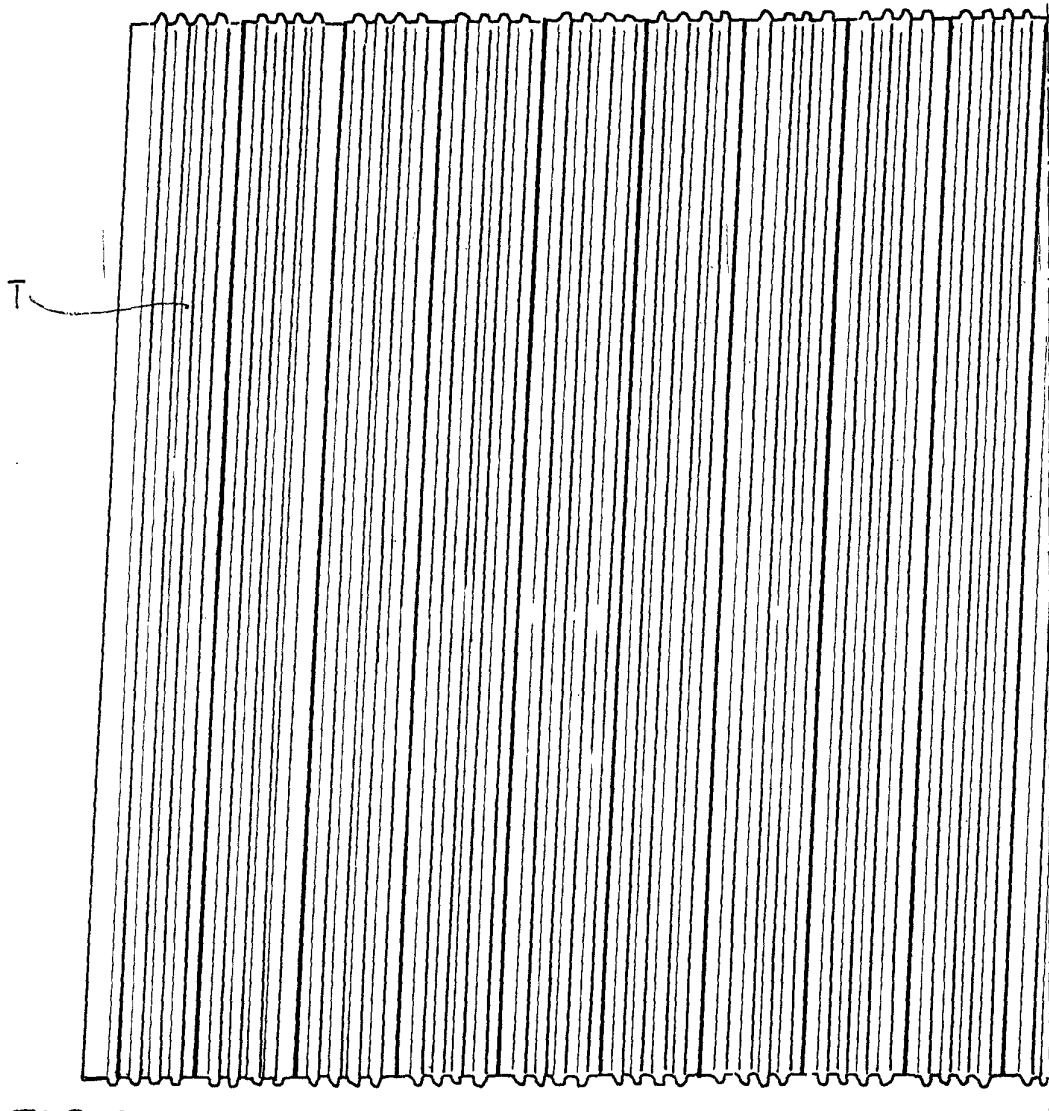


FIG. 1

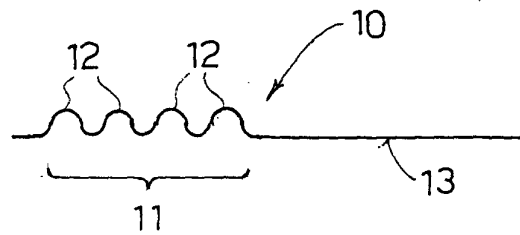


FIG. 2

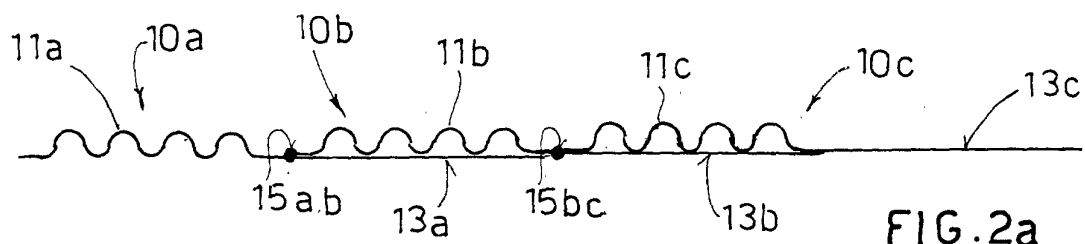
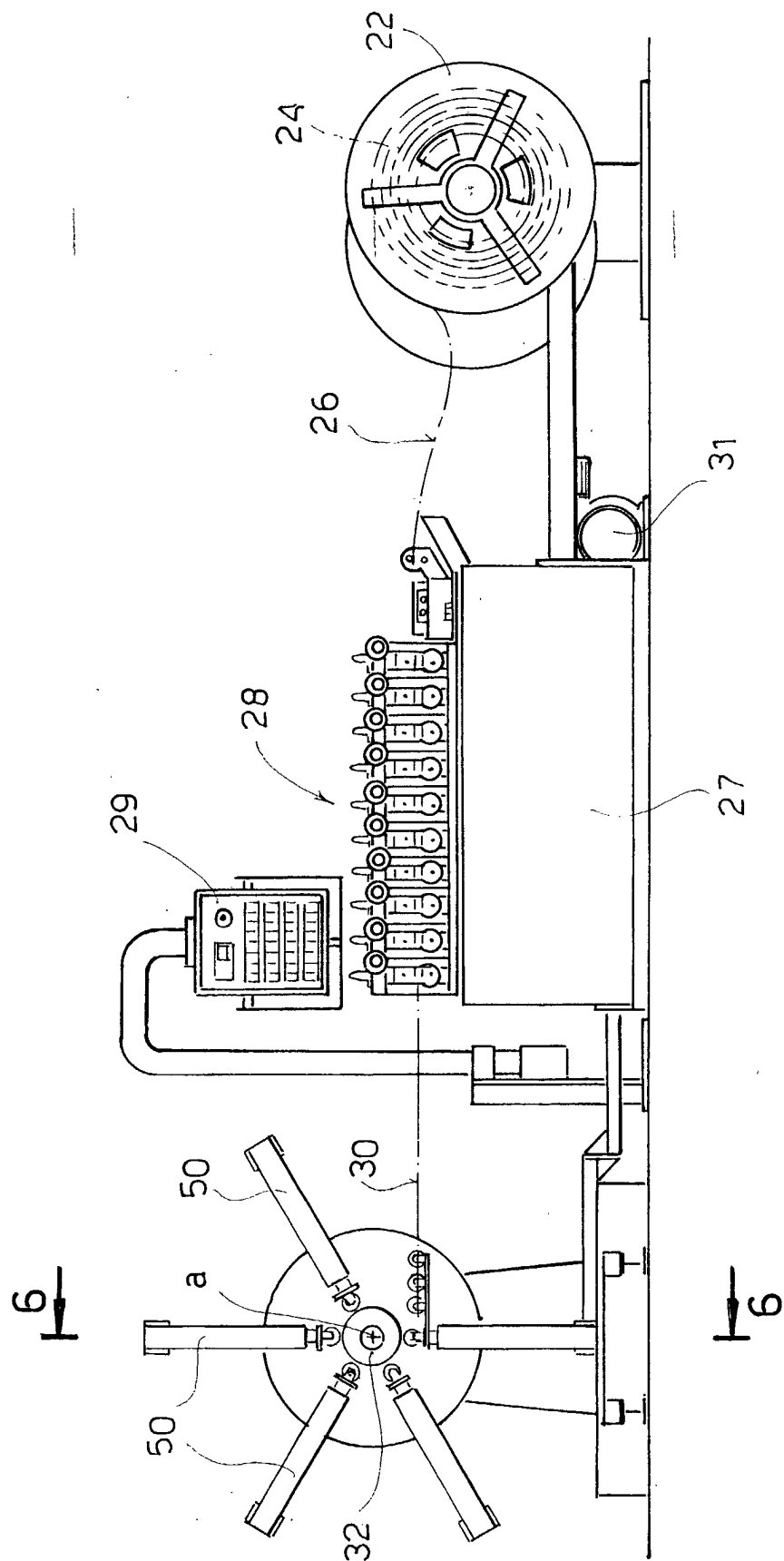


FIG. 2a

FIG. 3



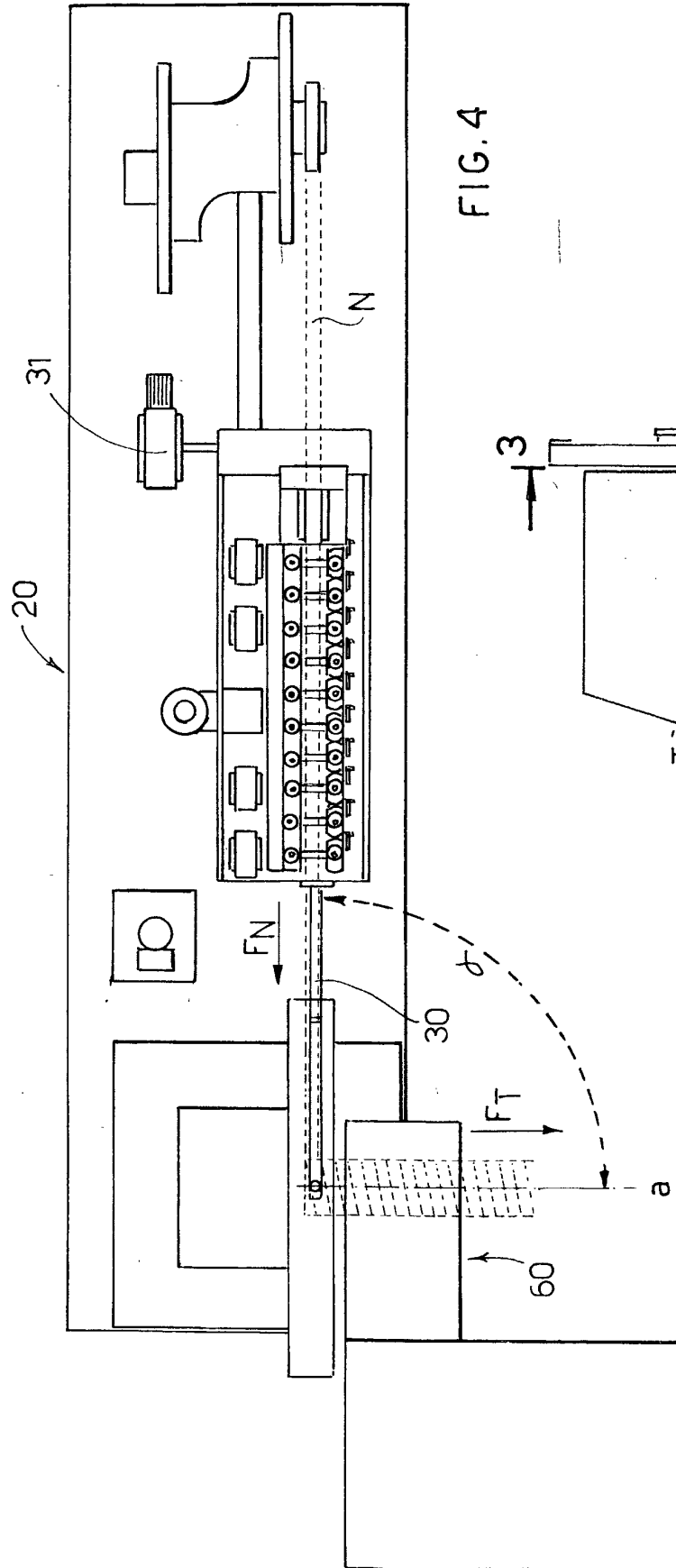


FIG. 4

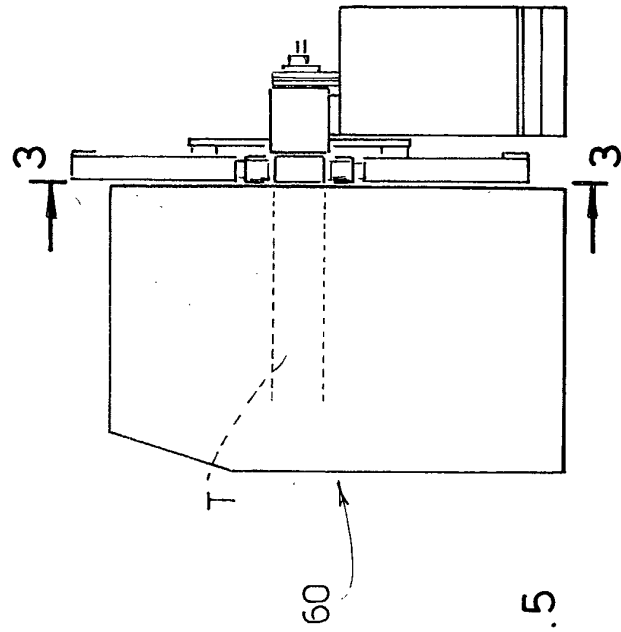


FIG. 5

