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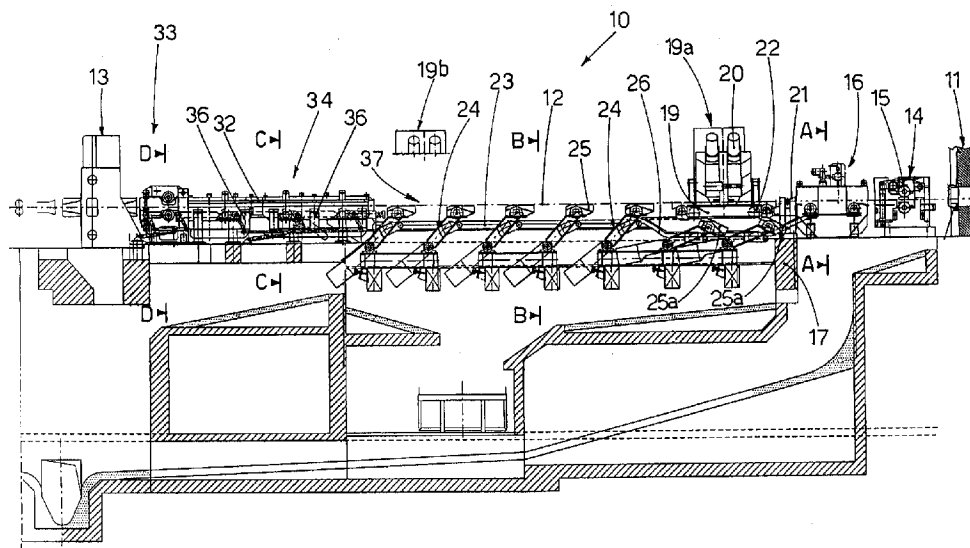
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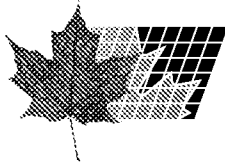
(54) **METHODE DE SOUDAGE DES BILLETES SORTANT D'UN
FOUR ET LIGNE DE LAMINAGE UTILISANT CETTE
METHODE**

(54) **METHOD TO WELD BILLETS LEAVING A FURNACE AND A
ROLLING LINE ADOPTING THE METHOD**



(57) Méthode de soudage des billettes sortant du four de réchauffage dans une ligne de laminage. Cette ligne comprend dans le segment (10) entre le four de réchauffage (11) et la première cage de laminage, au moins une unité d'étirage (14), un chemin de roulement pour transporter les billettes, une unité de soudage mobile (20) pourvue de mâchoires de soudage (31) et une cisaille d'urgence (13). L'extrémité arrière de la billette (12a) qu'on est à laminier est soudée à l'extrémité avant de la billette (12b) déchargée par la suite du four de réchauffage (11) pendant que les billettes (12) sont déplacées par une unité de soudage (20) installée sur un chariot mobile (19). Ce chariot (19) a trois positions : la première où il est immobile et attend que les extrémités des billettes (12) à réunir soient en contact; la deuxième

(57) Method to weld billets leaving a heating furnace in a rolling line, the line comprising, in the segment (10) between the heating furnace (11) and the first rolling stand, at least a drawing unit (14), a rollerway to transport the billets, a movable welding assembly (20) with welding jaws (31) and an emergency shears (13), wherein the trailing end of the billet (12a) being rolled is welded to the leading end of the billet (12b) unloaded afterwards from the furnace (11) while the billets (12) are in movement by a welding assembly (20) mounted on a movable trolley (19), the movable trolley (19) having a first, stationary condition while it waits for the position of contact between the ends of the billets (12) to be coupled, a second condition as it advances, wherein it is taken substantially to the rolling speed, grips the billets



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où il avance et atteint essentiellement la vitesse de laminage, saisit les billettes (12) avec les mâchoires (31) de l'unité de soudage (20) et soude les extrémités des billettes (12), et la troisième, appelée retrait, où il retourne à son point de départ. L'étape de soudage suit l'étape de décalaminage réalisée par l'unité de décalaminage (16) dans laquelle les faces avant des billettes (12) et, au moins, les zones des billettes (12) saisies par les mâchoires (31) sont décalaminées. Suit l'étape d'éboutage selon un plan parallèle des extrémités arrière et avant des billettes (12) effectuée par une d'ébouteuse (29) équipée d'au moins une lame rotative (27) et installée sur le chariot mobile (19) immédiatement en amont de l'unité de soudage (20); le soudage est suivi de l'élimination des bourrelets au moyen d'une unité d'élimination (38) pendant le déplacement de la billette (12). La ligne de laminage des billettes utilisant la méthode du soudage en mouvement à la sortie du four de réchauffage comme dans toute revendication susmentionnée, comprend dans le segment (10) - 18 - entre le four de réchauffage (11) et la première cage de laminoir, au moins une unité d'étirage (14), un chemin de roulement pour transporter les billettes, une unité mobile de soudage (20) incluant des mâchoires de soudage (31), et une cisaille d'urgence (13); la ligne de laminage comprend en aval de l'unité d'étirage (14), une première unité de décalaminage fixe (16), un chariot mobile (19) qui va et vient sur ses voies de roulement (23); le chariot mobile (19) supporte au moins une unité de soudage (20) équipée de mâchoires (31) servant à saisir les billettes (12), une ébouteuse (29) et une unité mobile de décalaminage (30); le chariot mobile (19) a deux positions : une première (19a) pendant qu'il attend les billettes (12), où il se trouve immédiatement après la première unité de décalaminage (16) et une deuxième position, où il est en fin de parcours (19b); un système de transport (37) muni de rouleaux (25) installés sur des supports pivotants (24) possédant une première position de fonctionnement et une deuxième, où ils sont rentrés, un système maintenant la température uniforme (34), une cisaille d'urgence (13).

(12) with the jaws (31) of the welding unit (20) and welds the ends of the billets (12), and a third condition of retreat where the movable trolley (19) returns to its starting position, the welding step being preceded by a descaling step carried out by a descaling unit (16) wherein the front faces of the billets (12) and at least those areas of the billets (12) cooperating with the jaws (31) are descaled, and by a parallel plane cropping step of the trailing end and leading end of the billets (12) carried out by a cropping unit (29) equipped with at least one rotary blade (27) and mounted on the movable trolley (19) immediately upstream of the welding assembly (20), the welding step being followed by a step to remove the flashed carried out by a flash removal unit (38) while the billet (12) is in movement. Rolling line for billets which adopts the moving welding method at the outlet of the heating furnace as in any claim hereinbefore, the line comprising, in the segment (10) - 18 - between the heating furnace (11) and the first rolling stand, at least a drawing unit (14), a rollerway to transport the billets, a movable welding assembly (20) including welding jaws (31) and an emergency shears (13), the line comprising, downstream of the drawing unit (14), a first, stationary descaling unit (16), a movable trolley (19) with an alternating movement on its relative runways (23), the movable trolley (19) supporting at least a welding assembly (20) with jaws (31) to grip the billets (12), a cropping unit (29) and a movable descaling unit (30), the movable trolley (19) including a first position (19a) while it waits for the billets (12) which is immediately downstream of the first, stationary descaling unit (16) and a second, end-of-travel position (19b), a transport path (37) with rollers (25) mounted on pivoting supports (24) having a first working position and a second, retracted position, a temperature maintaining system (34), an emergency shears (13).



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1 ABSTRACT

2 Method to weld billets leaving a heating furnace in a
3 rolling line, the line comprising, in the segment (10)
4 between the heating furnace (11) and the first rolling
5 stand, at least a drawing unit (14), a rollerway to
6 transport the billets, a movable welding assembly (20) with
7 welding jaws (31) and an emergency shears (13), wherein the
8 trailing end of the billet (12a) being rolled is welded to
9 the leading end of the billet (12b) unloaded afterwards from
10 the furnace (11) while the billets (12) are in movement by a
11 welding assembly (20) mounted on a movable trolley (19), the
12 movable trolley (19) having a first, stationary condition
13 while it waits for the position of contact between the ends
14 of the billets (12) to be coupled, a second condition as it
15 advances, where it is taken substantially to the rolling
16 speed, grips the billets (12) with the jaws (31) of the
17 welding unit (20) and welds the ends of the billets (12),
18 and a third condition of retreat where the movable trolley
19 (19) returns to its starting position, the welding step
20 being preceded by a descaling step carried out by a
21 descaling unit (16) wherein the front faces of the billets
22 (12) and at least those areas of the billets (12)
23 cooperating with the jaws (31) are descaled, and by a
24 parallel plane cropping step of the trailing end and leading
25 end of the billets (12) carried out by a cropping unit (29)
26 equipped with at least one rotary blade (27) and mounted on
27 the movable trolley (19) immediately upstream of the welding
28 assembly (20), the welding step being followed by a step to
29 remove the flashes carried out by a flash removal unit (38)
30 while the billet (12) is in movement.

31 Rolling line for billets which adopts the moving welding
32 method at the outlet of the heating furnace as in any claim
33 hereinbefore, the line comprising, in the segment (10)

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1 between the heating furnace (11) and the first rolling
2 stand, at least a drawing unit (14), a rollerway to
3 transport the billets, a movable welding assembly (20)
4 including welding jaws (31) and an emergency shears (13),
5 the line comprising, downstream of the drawing unit (14), a
6 first, stationary descaling unit (16), a movable trolley
7 (19) with an alternating movement on its relative runways
8 (23), the movable trolley (19) supporting at least a welding
9 assembly (20) with jaws (31) to grip the billets (12), a
10 cropping unit (29) and a movable descaling unit (30), the
11 movable trolley (19) including a first position (19a) while
12 it waits for the billets (12) which is immediately
13 downstream of the first, stationary descaling unit (16) and
14 a second, end-of-travel position (19b), a transport path
15 (37) with rollers (25) mounted on pivoting supports (24)
16 having a first working position and a second, retracted
17 position, a temperature maintaining system (34), an
18 emergency shears (13).

- 1 -

1 "METHOD TO WELD BILLETS LEAVING A FURNACE AND A ROLLING LINE
2 ADOPTING THE METHOD"

3 * * * * *

4 This invention concerns a method to weld billets leaving a
5 heating furnace, and also the rolling line which adopts this
6 method, as set forth in the respective main claims.

7 The invention is applied particularly, but not only, in
8 the rolling of billets where it is desired to obtain a
9 substantially continuous feed, whether it be a completely
10 hot load or also a mixed hot and cold load, from the heating
11 furnace to the rolling train.

12 In rolling processes for billets where the rolling train
13 is located in line with the continuous casting machine, the
14 state of the art covers the need to ensure a high
15 productivity of the plant but without causing a reduction in
16 the surface quality and the inner quality of the final
17 product.

18 It is also necessary to make the work times of the rolling
19 train compatible with the casting times, in order to prevent
20 a discontinuous functioning of the rolling stands with all
21 the problems connected to the correct use of the rolling
22 rolls and their activation.

23 In the art of rolling mills, systems have been proposed
24 which teach to weld the trailing end of the billet which is
25 already being rolled, with the leading end of the next
26 billet arriving from the casting machine, or fed from buffer
27 stores associated with the line, in order to ensure a
28 substantially continuous feed to the rolling train.

29 US-A-2.214.618 provides to weld the leading end of a strip
30 with the trailing end of the strip being worked, while
31 stationary.

32 In order to do this, it is necessary to slow down the
33 cycle or use buffer stores which can be included only when

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1 plate or wide plate is being worked.

2 These buffer store systems are not only complicated and
3 complex, but they must also work at temperature and require
4 considerable vertical space.

5 In addition, these systems cannot be adopted in the case
6 of billets, so that the stationary welding machine would
7 block the rolling cycle downstream, causing a loss of
8 productivity, marking of the product, problems in re-
9 starting, etc.

10 DE-A-2.836.338 indicates generally a welding process with
11 a movable welding system which follows the billet.

12 The indications are very generic and do not give any
13 information about how the leading end billet and trailing
14 end billet are treated, or how the welding machine
15 functions.

16 However, the welding systems known to the state of the art
17 have shown they have great problems, both in operation and
18 in technology, which until now have prevented this technique
19 from being used reliably on a larger scale of products and
20 processes, without altering the productivity of the line
21 and/or the quality of the final product.

22 One of the main problems is that if the surfaces of the
23 two ends which are to be welded are not exactly plane and
24 parallel, the welding is imprecise, it takes longer to carry
25 out and the final result is not satisfactory.

26 Moreover, the presence of a large quantity of scale on the
27 billets as they leave the furnace impedes the welding, makes
28 it difficult and unreliable, as the scale impedes the
29 correct passage of the current on the gripping jaws which
30 carry out the welding.

31 A further problem is that, once the welding has been
32 carried out, the surface area which has been welded has a
33 temperature which is not uniform with respect to the core of

1 the billet, and this creates problems in the initial
2 squeezing step carried out by the rolling rolls and a
3 consequent poorer quality of the product.

4 It is also a problem to remove the flashes caused by flash
5 pressure welding.

6 A further problem is the need to include a system to
7 intervene rapidly to separate the billet which has been
8 rolled from the billet to be rolled when there is a blockage
9 in the rolling train.

10 Another problem is the unequal geometry of the leading end
11 of one billet compared with the trailing end of the
12 preceding billet.

13 The present applicants have designed, tested and embodied
14 this invention to overcome these shortcomings of the state
15 of the art and to achieve further advantages.

16 This invention is set forth and characterised in the
17 respective main claims, while the dependent claims describe
18 variants of the idea of the main embodiment.

19 The main purpose of the invention is to provide a method
20 to weld billets leaving a heating furnace which will
21 overcome the above-mentioned problems, and make it possible
22 to use this welding reliably and efficiently so as to obtain
23 a continuous feed to the rolling train.

24 Another purpose of the invention is to provide a rolling
25 line which, by adopting the welding method as above, will
26 make it possible to optimise productivity without reducing
27 in any way the surface quality and the outer quality of the
28 final product.

29 The welding method according to the invention is applied
30 to billets leaving a heating furnace inside which the
31 billets produced by one or more continuous casting machines,
32 or cold billets taken from buffer stores, or a mixture of
33 hot and cold billets, are progressively accumulated.

1 According to the invention, the welding machine at the
2 outlet of the heating furnace is placed on a movable trolley
3 and moves, in a coordinated manner with the billet being
4 rolled, to carry out the welding as the billet moves.

5 At the outlet of the heating furnace and upstream of the
6 movable trolley there is a first descaling unit attached to
7 the ground.

8 In one embodiment of the invention, this first descaling
9 device has rotary nozzles; according to a variant the first
10 descaling device is of the mixed type, with both stationary
11 and rotary nozzles.

12 The stationary nozzles are used to descale the leading
13 ends of the billets while the rotary nozzles are used to
14 descale the area of contact with the welding jaws or,
15 according to a further variant, for the whole length of the
16 billet.

17 According to the invention, the jaws of the welding
18 machine centre the billets on a geometric axis of the
19 section in such a way that the billets are centred correctly
20 even when the billets do not have homogenous sections.

21 According to a variant of the invention, on the movable
22 trolley which carries the welding machine, and upstream of
23 it, there is a second descaling unit which cleans the
24 surface of the billets which are to be welded and
25 particularly the area where the billets are joined.

26 In one formulation of the invention this second descaling
27 unit is of the rotary kind.

28 The combination of a rotary descaling device placed
29 immediately upstream of the welding machine, together with
30 the fact that the second descaling device moves with the
31 machine and follows its movement, causes an extremely
32 efficient action of removal of the scale; what is more, the
33 scale does not have time to re-form before welding takes

1 place.

2 The complete absence of scale on the surface of the
3 billets being welded facilitates the passage of the current
4 between the welding jaws and thus improves and accelerates
5 the start of the welding cycle.

6 According to a variant of the invention, at least the
7 second descender can be automatically adjusted with regard to
8 descaling times, water flow and/or pressure according to the
9 type of scale to be removed and/or the type of product being
10 rolled.

11 According to the invention, between the second descender
12 and the welding machine, on the movable trolley, there is at
13 least a cropping unit to crop the leading and trailing ends
14 of the billets to be coupled.

15 This cropping unit arranges the two surfaces in such a way
16 that, apart from being without scale, they are also
17 perfectly plane and parallel to each other, which
18 considerably improves the efficiency of the welding.

19 In one embodiment of the invention, the cropping unit is
20 composed of a cropping machine with at least one rotary
21 blade.

22 According to a variant, the cropping machine has two
23 rotary blades installed on a single blade-bearing mandrel,
24 and the blades crop the leading end of one billet and the
25 trailing end of the other billet at one and the same time.

26 According to one embodiment of the invention, on the
27 welding trolley there is a unit to remove the welding
28 flashes.

29 According to the invention, the transport way for the
30 billets leaving the furnace is of the type with one channel
31 and is composed of successive rollers mounted on pivoting
32 supports.

33 During the welding cycle these pivoting supports are bent

1 by the advance of the movable trolley carrying the welding
2 machine and rise again after the passage of the movable
3 trolley to act as a support for the billet again.

4 Downstream of the pivoting rollerway there is an emergency
5 drawing unit which is used to send back the billet which
6 still has to be rolled, in the event of a blockage in the
7 rolling train.

8 This emergency drawing unit cooperates with an emergency
9 shears located downstream of the drawing unit which is able
10 to separate the rolled billet from the billet which still
11 has to be rolled.

12 According to the invention, in a position adjacent to the
13 rollerway and outside the line, there is a storage surface
14 onto which billets present on the rollerway can be unloaded
15 in the event of a blockage in the rolling train.

16 According to a variant of the invention, at the outlet of
17 the pivoting rollerway and downstream from the end-of-travel
18 of the movable trolley of the welding machine, there is a
19 heating system able to make the temperature uniform,
20 particularly of the edges and/or the area where the billets
21 are joined.

22 This heating system, according to one embodiment, is of
23 the induction type.

24 According to a variant, the heating system is configured
25 as a tunnel furnace with heating means.

26 According to a further variant, the heating system is of
27 the flash type.

28 In cooperation with the heating system there are also
29 containing elements with bottoms which can be opened so as
30 to unload and remove the scale and waste which are produced
31 during the passage and the heating of the billets.

32 The attached figures are given as a non-restrictive
33 example, and show a preferred solution of the invention as

1 follows:

2 Fig.1 shows a longitudinal section of one segment of the
3 rolling line which adopts the welding method
4 according to the invention;

5 Fig.2 shows the section from A to A of Fig.1;

6 Fig.3 shows the section from B to B of Fig.1;

7 Fig.4 shows the section from C to C of Fig.1;

8 Fig.5 shows the section from D to D of Fig.1;

9 Fig.6 shows a detail of the movable trolley carrying the
10 welding machine shown in Fig.1;

11 Fig.7 shows the welding cycle used in the method according
12 to the invention.

13 In Fig.1, the number 10 denotes generally the segment of a
14 rolling line placed between a heating furnace 11, which is
15 only partly shown here, for billets 12 and an emergency
16 pendulum shears 13 placed before the inlet to the rolling
17 train, which is not shown here, served by a drawing unit 33.

18 The heating furnace 11 is of the type arranged to
19 accumulate billets 12 from several casting lines and/or to
20 mix feed the hot/cold billets 12; it cooperates upstream
21 with transport and feeding means of a type known to the
22 state of the art.

23 According to a variant not shown here, for products which
24 do not need particularly high standards of quality, the
25 furnace 11 cooperates upstream with cropping means to crop
26 the leading and trailing ends of the billets 12 which are to
27 be sent for welding.

28 In this case the cropping is carried out cold, for example
29 with disk-type rotary saws to cut the billets 12 of various
30 lengths.

31 At the outlet of the heating furnace 11 there is a drawing
32 unit 14 with pinch rolls 15.

33 This drawing unit 14 serves to move the billet 12 as it

1 leaves the furnace at a variable speed according to need.

2 Downstream of the drawing unit 14 there is a first
3 descaling device 16 of the mixed type, attached to the
4 foundation surface 17, with nozzles 18 both of the
5 stationary type and the rotary type.

6 In particular, in this case, the nozzles 18 of the
7 stationary type serve to remove the scale from the surface
8 of the billets 12 in correspondence with the leading ends,
9 while the nozzles 18 of the rotary type serve to remove the
10 scale at least from the area of the billets which, in the
11 following stage, will be the area of contact with the
12 welding jaws 31.

13 If necessary, the nozzles 18 of the rotary type carry out
14 the descaling over the whole length of the billet 12.

15 Downstream of the first descender 16 there is the movable
16 trolley 19 on which is mounted the welding assembly 20.

17 In this case, between the first descender 16 and the
18 movable trolley 19 there is a retractable clamping device 21
19 which clamps the billet 12 in the event that there is a
20 blockage downstream.

21 The movable trolley 19 has wheels 22 and moves with an
22 alternate motion on runways 23, such as rails, guides or
23 similar, according to the advance of the billets 12 to be
24 coupled.

25 The advance of the movable trolley 19 causes the lowering
26 of the pivoting supports 24 on which are mounted the rollers
27 25 which constitute the motorised rollerway 37 which
28 supports and feeds the billets 12.

29 This lowering is achieved by a fork-type element 26, solid
30 during the advance of the movable trolley 19, in such a way
31 that the supports 24 with the relative rollers 25 are
32 lowered below the movable trolley 19 during the advance of
33 the latter (see rollers 25a), and rise again, thanks to a

1 lifting system or counterweight, once the movable trolley 19
2 has passed them by, so as to support the advancing billets
3 12 again.

4 The complete retraction of the roller 25 below the movable
5 trolley 19 is achieved by the very low position of the
6 centre of rotation of the relative pivoting support 24.

7 In this case, on the movable trolley 19 and upstream of
8 the welding assembly 20 there is a cropping device 29 with a
9 double rotary blade, respectively 27a front and 27b rear,
10 which are used to crop the rear or trailing end of the
11 billet 12 placed in front, and the front or leading end of
12 the billet 12 placed behind.

13 The two blades 27a and 27b are mounted, in this case, on a
14 single mandrel 28 to reduce as much as possible the cutting
15 times and are arranged, in this case, to crop the ends
16 according to a desired length.

17 In this case, the blade-bearing mandrel 28 is supported by
18 a movable support moved by a hydraulic cylinder which has a
19 controlled speed.

20 The rotation of the blades 27a and 27b is achieved by
21 means of an electric motor possibly incorporating mechanical
22 transmission.

23 The pitch between the two blades 27a and 27b is, in this
24 case, between about 30 and about 70 mm, advantageously
25 between 40 and 50 mm.

26 The cropping machine 29 serves to arrange perfectly plane
27 and parallel surfaces for the welding, so that the welding
28 process gives a perfect coupling and therefore a perfect
29 join.

30 In the event that cropping is carried out upstream of the
31 furnace 11, the cracks and bubbles can oxydise during the
32 pre-heating step, which creates problems with the products
33 and reduces the final quality of the rolled stock.

1 In this case, on the movable trolley 19 is mounted a
2 second descender 30 of the rotary type, which has the
3 function of completing the descender action carried out by
4 the first descender 16 and in particular of cleaning in the
5 best possible way the part of the surface of the billets 12
6 which will later find itself in contact with the jaws 31 of
7 the welding assembly 20.

8 The cleaning of this contact area ensures the optimum
9 passage of the current from the welding jaws 31 and
10 therefore an efficient and rapid start to and completion of
11 the welding cycle.

12 In this case, the second descender 30 has adjustable
13 working parameters, both as regards the descender times and
14 as regards the water flow and/or pressure.

15 Downstream of the welding assembly 20 on the trolley 19
16 itself there is a unit to remove the flashes 38 which serves
17 to eliminate the welding flashes.

18 Moreover, the jaws 31 centre the billet 12 on the ideal
19 centering axis 39 of the section of the billet 12 itself, so
20 that this compensates for any geometric differences in
21 section between the two billets 12 to be coupled.

22 With respect to the welding cycle, the forward movement of
23 the movable trolley 19 is correlated to the advance of the
24 billets 12 from an initial position 19a to an end-of-travel
25 position identified diagrammatically by 19b.

26 The continuous billet 12 leaving the movable trolley 19 is
27 introduced inside a maintenance system 34 comprising at
28 least a movable cope 32, associated at the outlet with a
29 drawing unit 33 arranged upstream of the emergency shears
30 13.

31 According to a variant, the maintenance system 34 is
32 associated with a heating system, for example by means of
33 burners, in order to render the temperature of the billets

1 12 uniform, particularly the edges of the billet 12.

2 According to another solution, the heating system
3 comprises an induction furnace.

4 This maintenance and possibly heating system 34 comprises
5 at the lower part doors 36 which can be opened to unload and
6 discharge the waste and scale which form on the surface of
7 the billet 12.

8 The emergency shears 13 and the drawing unit 33 intervene
9 in the event of a blockage in the rolling train, the first
10 to separate the billet 12 which has already been rolled from
11 the one which still has to be rolled, and the second to take
12 the latter billet 12 back on the rollerway 37.

13 The stationary billet is then transferred if necessary, by
14 means of extendable mechanical hands, onto a storage surface
15 35 located off line at the side of the rollerway 37.

16 Fig.7 shows the various steps of the welding method
17 according to the invention.

18 In Figs.7a, 7b, 7c, and 7d the billet 12a is progressively
19 unloaded from the furnace 11 until the leading end
20 cooperates with the movable trolley 19 which carries the
21 welding assembly.

22 The billet 12a is then slowed down until it reaches
23 substantially the rolling speed and then (Figs. 7e, 7f) the
24 billet 12b is unloaded from the furnace 11.

25 The billet 12b, with a much higher outlet speed than that
26 of the billet 12a, rapidly approaches the billet 12a (Fig.
27 7g) until the respective ends are in contact (Fig. 7h)
28 inside the movable trolley 19.

29 At this point, the movable trolley 19 is activated until
30 it reaches substantially the rolling speed (Figs. 7i, 7l).

31 In that part of the travel of the movable trolley 19 which
32 is indicated by the letter 'b', between the position shown
33 in Fig.7l and that in Fig.7n, the leading end and trailing

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1 end of the billets 12a and 12b are cropped, and welded by
2 means of the welding jaws 31.

3 Once welding has been completed, and the end-of-travel
4 position reached, the movable trolley 19 stops, and begins
5 its return journey in the opposite direction until it
6 repositions itself in its starting position (Figs. 7o, 7p,
7 7q, and 7r).

8 During the return journey of the movable trolley 19, the
9 billet 12c begins to be unloaded from the heating furnace 11
10 at a speed which is much higher than the speed at which the
11 billets 12a and 12b, joined together, are advancing, until,
12 substantially at the same time that the movable trolley 19
13 reaches its original starting position, the leading end of
14 the billet 12c comes into contact with the trailing end of
15 the billet 12b (Fig. 7s).

16 At this point the welding cycle as described above begins
17 again (Fig. 7t).

1 CLAIMS

2 1 - Method to weld billets leaving a heating furnace in a
3 rolling line, the line comprising, in the segment (10)
4 between the heating furnace (11) and the first rolling
5 stand, at least a drawing unit (14), a rollerway to
6 transport the billets, a movable welding assembly (20) with
7 welding jaws (31) and an emergency shears (13), wherein the
8 trailing end of the billet (12a) being rolled is welded to
9 the leading end of the billet (12b) unloaded afterwards from
10 the furnace (11) while the billets (12) are in movement by a
11 welding assembly (20) mounted on a movable trolley (19), the
12 method being characterised in that the movable trolley (19)
13 has a first, stationary condition while it waits for the
14 position of contact between the ends of the billets (12) to
15 be coupled, a second condition as it advances, where it is
16 taken substantially to the rolling speed, grips the billets
17 (12) with the jaws (31) of the welding unit (20) and welds
18 the ends of the billets (12), and a third condition of
19 retreat where the movable trolley (19) returns to its
20 starting position, the welding step being preceded by a
21 descaling step carried out by a descaling unit (16) wherein
22 the front faces of the billets (12) and at least those areas
23 of the billets (12) cooperating with the jaws (31) are
24 descaled, and by a parallel plane cropping step of the
25 trailing end and leading end of the billets (12) carried out
26 by a cropping unit (29) equipped with at least one rotary
27 blade (27) and mounted on the movable trolley (19)
28 immediately upstream of the welding assembly (20), the
29 welding step being followed by a step to remove the flashes
30 carried out by a flash removal unit (38) while the billet
31 (12) is in movement.

32 2 - Method as in Claim 1, in which the billets (12) are
33 centred in the jaws (31) of the welding assembly (20) along

- 1 an ideal centering axis (39) of the section of the billets
2 (12) themselves
- 3 3 - Method as in any claim hereinbefore, in which the billet
4 (12) is subjected to a second descaling step by a movable
5 descaling unit (30) immediately upstream of the welding
6 step.
- 7 4 - Method as in any claim hereinbefore, in which the
8 cropping unit (29) comprises a system with a double rotary
9 blade (27a, 27b) associated with a single mandrel (28), the
10 first blade (27a) arranged to crop the trailing end of the
11 billet (12a) located further forward, the other blade (27b)
12 arranged for the simultaneous and parallel cropping of the
13 leading end of the billet (12b) located behind.
- 14 5 - Method as in any claim hereinbefore, in which the
15 cropping step of the relative ends of the billets (12) is
16 preceded by a descaling step carried out while the billet is
17 in movement by a second descaling unit (30) mounted on the
18 movable trolley (19).
- 19 6 - Method as in Claim 5, in which the second descaler (30)
20 is of the rotary type and acts specifically in
21 correspondence with the area where the billets (12) are
22 joined.
- 23 7 - Method as in Claim 5 or 6, in which the second descaler
24 (30) has descaling times and/or parameters for the flow
25 and/or pressure of water which can be adjusted.
- 26 8 - Method as in any claim hereinbefore, in which the welded
27 billet (12), before entering the rolling mill, is subjected
28 to an at least localised heating action.
- 29 9 - Method as in Claim 8, in which the heating action is
30 obtained by an induction system.
- 31 10 - Method as in Claim 8, in which the heating is obtained
32 with a flash system.
- 33 11 - Method as in Claim 8, in which the heating is obtained

- 1 with a heating tunnel system.
- 2 12 - Rolling line for billets which adopts the moving
3 welding method at the outlet of the heating furnace as in
4 any claim hereinbefore, the line comprising, in the segment
5 (10) between the heating furnace (11) and the first rolling
6 stand, at least a drawing unit (14), a rollerway to
7 transport the billets, a movable welding assembly (20)
8 including welding jaws (31) and an emergency shears (13),
9 the line being characterised in that it comprises,
10 downstream of the drawing unit (14), a first, stationary
11 descaling unit (16), a movable trolley (19) with an
12 alternating movement on its relative runways (23), the
13 movable trolley (19) supporting at least a welding assembly
14 (20) with jaws (31) to grip the billets (12), a cropping
15 unit (29) and a movable descaling unit (30), the movable
16 trolley (19) including a first position (19a) while it waits
17 for the billets (12) which is immediately downstream of the
18 first, stationary descaling unit (16) and a second, end-of-
19 travel position (19b), a transport path (37) with rollers
20 (25) mounted on pivoting supports (24) having a first
21 working position and a second, retracted position, a
22 temperature maintaining system (34), an emergency shears
23 (13).
- 24 13 - Rolling line as in Claim 12, in which the first
25 stationary descaling unit (16) includes nozzles (18) of the
26 stationary type and nozzles (18) of the rotary type.
- 27 14 - Rolling line as in Claim 12 or 13, in which the welding
28 jaws (31) are movable along the ideal centering axis (39) of
29 the section of the billets (12).
- 30 15 - Rolling line as in any claim from 12 to 14 inclusive,
31 in which there is a unit to remove the flashes (38) on the
32 movable trolley (19).
- 33 16 - Rolling line as in any claim from 12 to 15 inclusive,

1 in which the second retracted position of the pivoting
2 supports (24) cooperates with the passage of the movable
3 trolley (19).

4 17 - Rolling line as in Claim 16, in which the movable
5 trolley (19) is associated at the front part with a fork
6 element (26) cooperating with the pivoting supports (24) to
7 take them from the first working position to the second
8 retracted position and vice versa.

9 18 - Rolling line as in any claim from 12 to 17 inclusive,
10 in which upstream of the emergency shears (13) there is a
11 drawing unit (33).

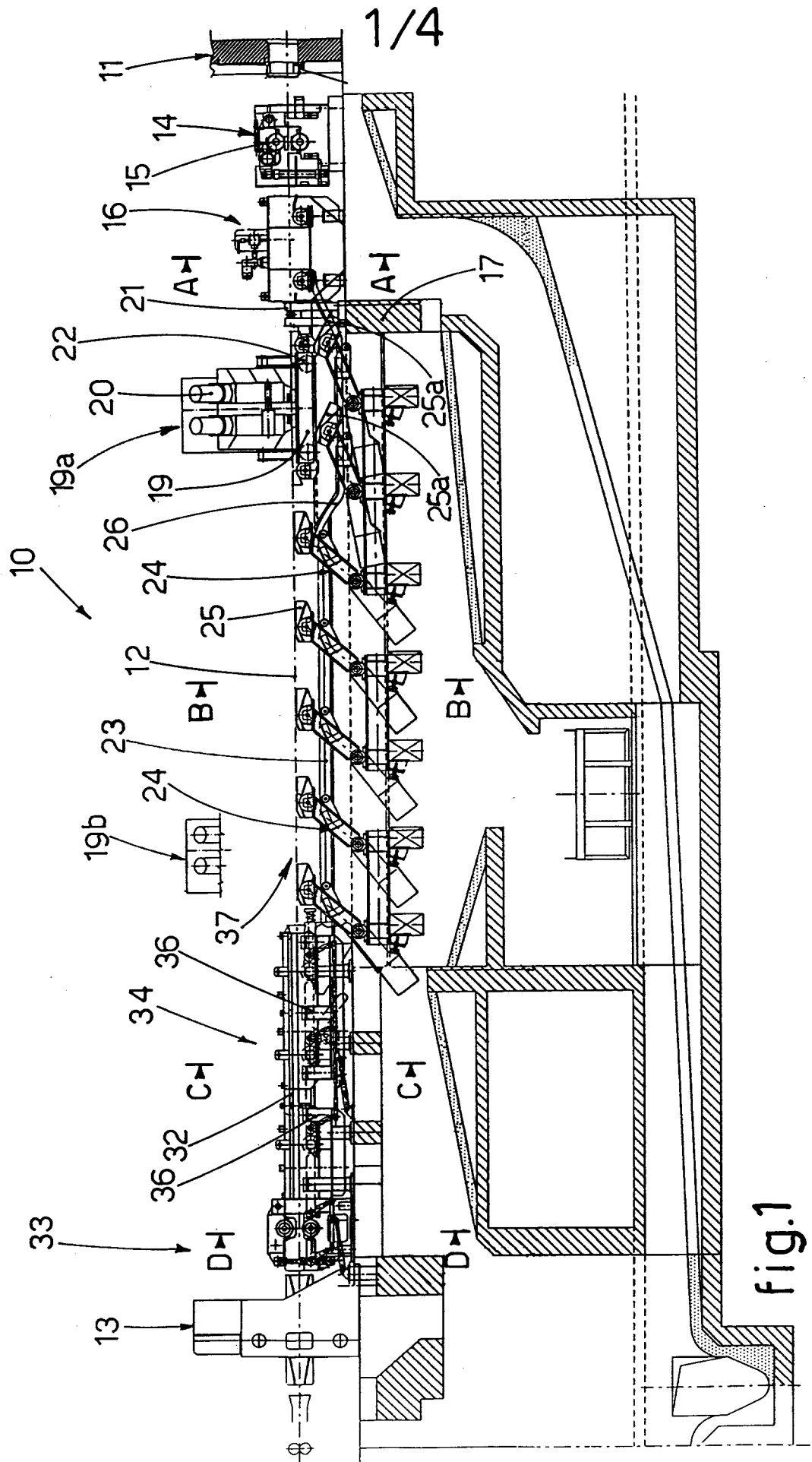
12 19 - Rolling line as in any claim from 12 to 18 inclusive, in
13 which, in a position adjacent to the rollerway (37) and off
14 line there is a storage surface (35) to temporarily
15 accumulate the billets (12) in the event that there is a
16 blockage in the rolling train.

17 20 - Rolling line as in any claim from 12 to 19 inclusive,
18 in which the temperature maintaining system (34) comprises
19 further heating means and means to make uniform the
20 temperature of the surface and core of the billet (12),
21 particularly in the area of the join.

22 21 - Rolling line as in Claim 20, in which the heating
23 system comprises a tunnel associated with heating burners.

24 22 - Rolling line as in Claim 20, in which the heating
25 system comprises rapid heating means of the induction type.

26 23 - Rolling line as in Claim 20, in which the temperature
27 maintaining system (34) is associated at the lower part with
28 containing elements with a bottom (36) which can be opened
29 to discharge and unload the waste and scale.



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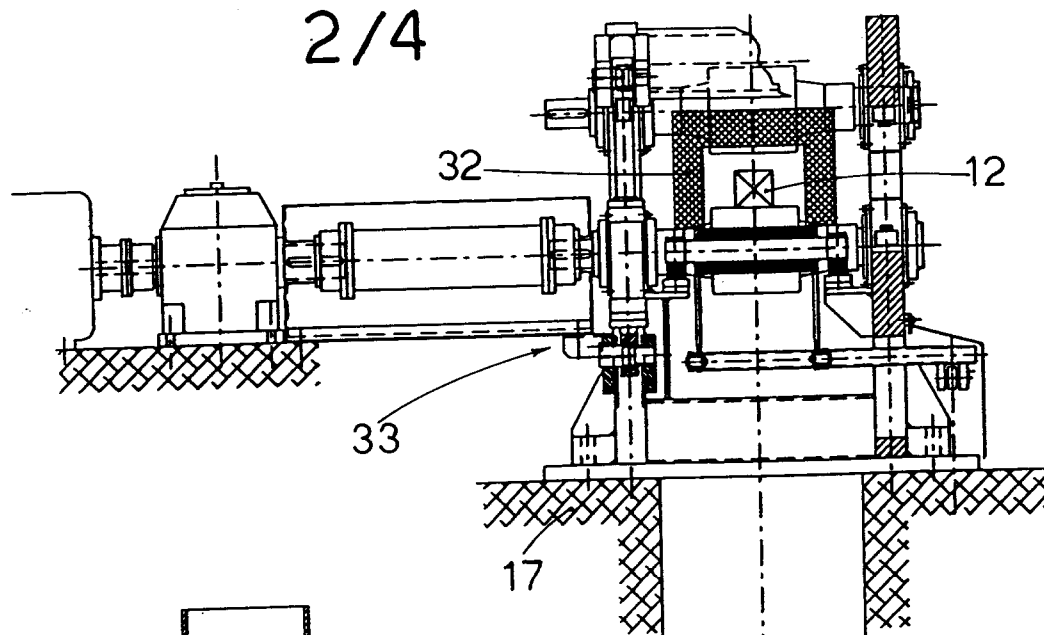


fig.5

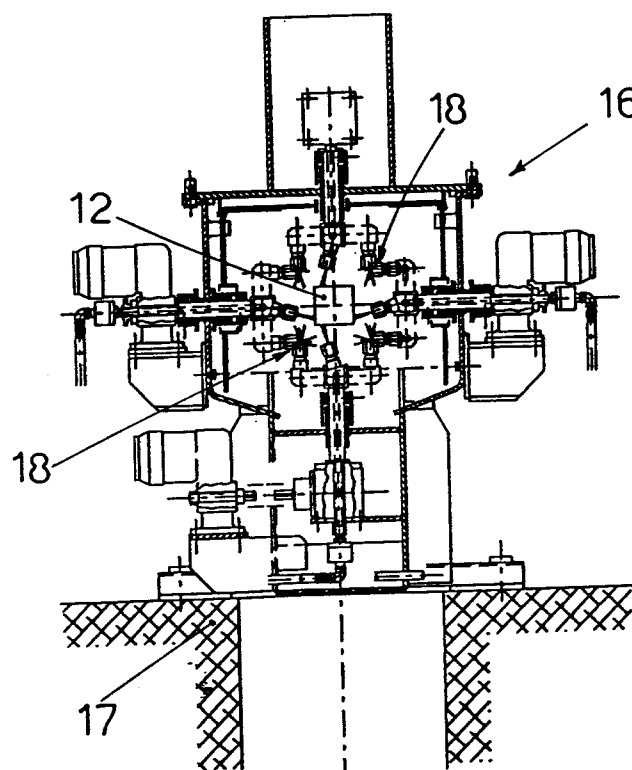


fig.2

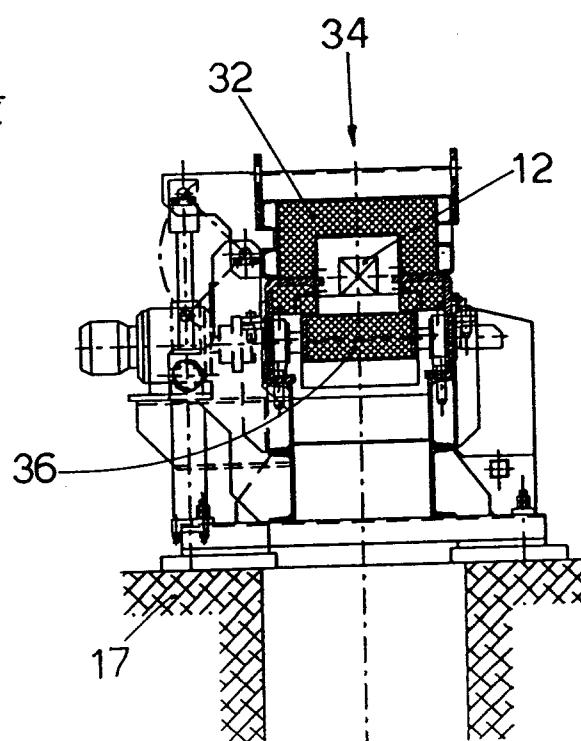


fig.4

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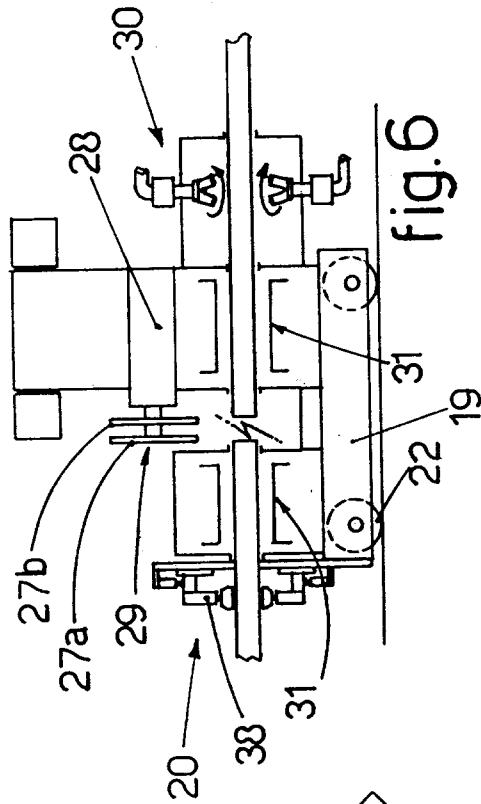


fig.6

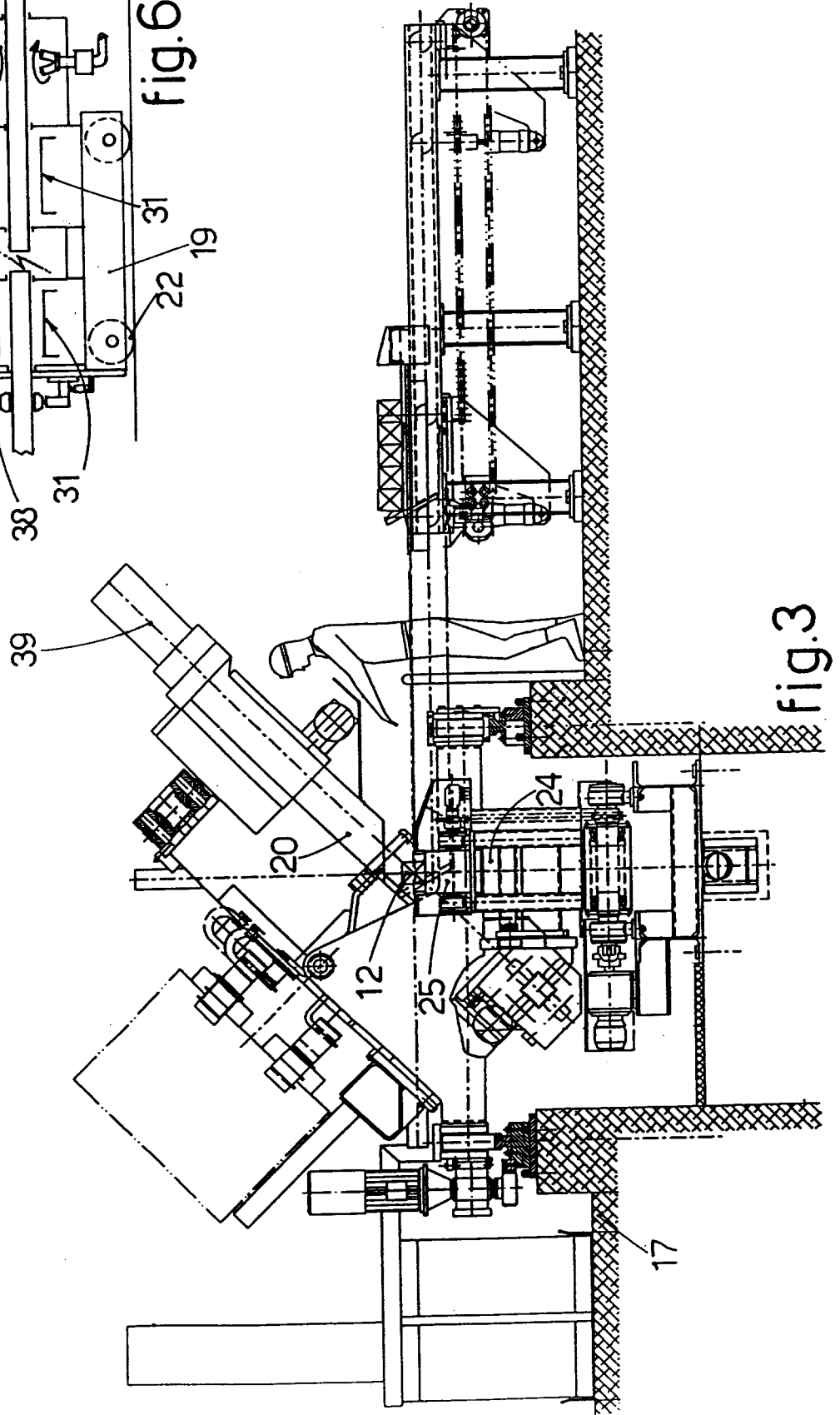


fig.3

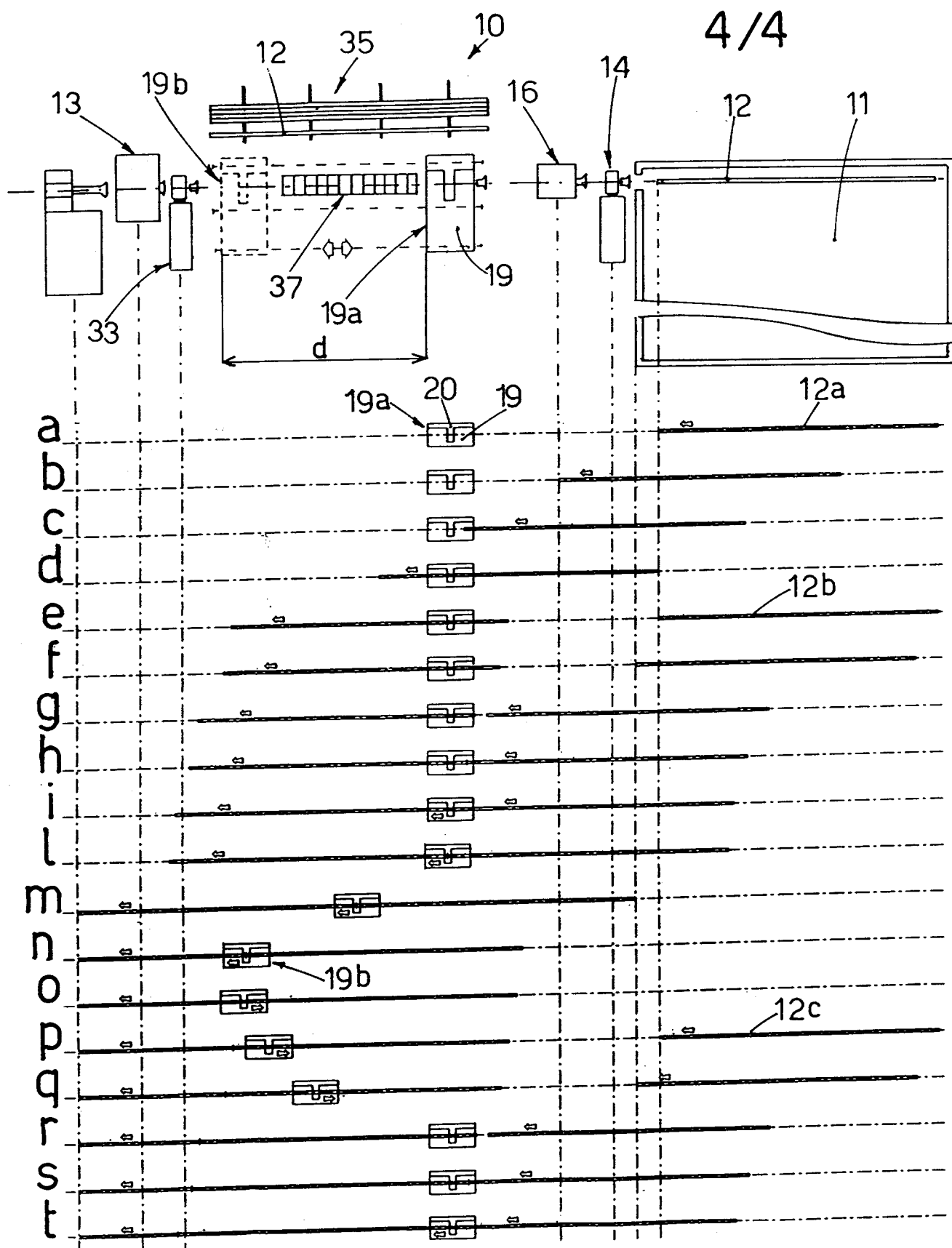


fig. 7

