

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.01.2014 Bulletin 2014/04

(51) Int Cl.: **B44B 5/00** (2006.01) **B21D 22/00** (2006.01)
B21H 1/00 (2006.01) **B21H 8/00** (2006.01)
B21D 51/00 (2006.01)

(21) Application number: **12184555.6**

(22) Date of filing: 14.09.2012

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR
 Designated Extension States:
BA ME

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(30) Priority: 18.07.2012 EP 12176954

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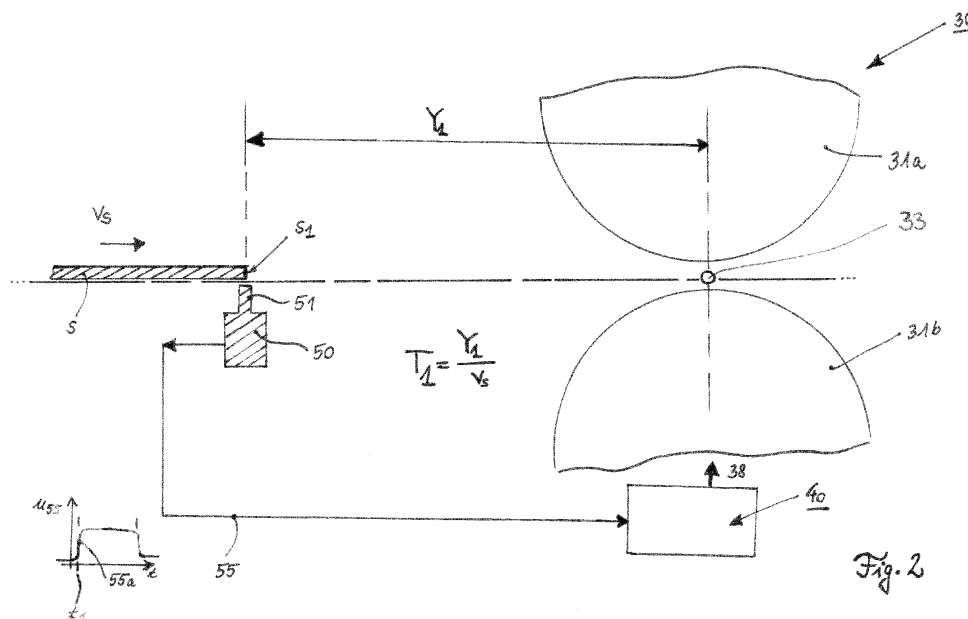
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(54) **Embossing a flat metal blank (method, apparatus and object)**

(57) Tool and method for embossing an artifact into a wall of a three-piece can, wherein a flat sheet or blank (s) of metal is transported along a transport bed (10) by several spaced apart groups of rollers (20,22,24), each having a top and a bottom roller. A rotating embossing roller pair (30) is provided between two of the groups of transport rollers, and driven by a servo drive (38). It embosses the artifact (11,11') into the flat, transported sheet

or blank. The transport rollers, the embossing rollers and the sheet or blank have the same speed at the surface of the blank during embossing the artifact into the blank or sheet, and a length position of the artifact in the sheet or blank is determined, adjusted or corrected by a speed and position control (40) of the servo drive, driving the embossing roller pair (30) and shaping a cylindrical base shape of the can wall (15).



Description

[0001] The invention concerns a method of embossing an artifact into a wall of a can. The metallic can maybe a three-piece can having a wall that has a vertical weld line. This weld line connects a cylindrically shaped wall and this wall receives a top end and a bottom end seamed thereto, to finish the can. Usually those cans are aerosol cans, paint cans or containers for antiperspirant (Deos). Those cans receive a nozzle on top that upon pressing releases the content that is under internal pressure.

[0002] The invention further concerns a tool (claim 10) that enables such embossing into a three-piece can, preferably into the wall of the three-piece can, prior to its shaping in to a cylindrical element and of course, prior to welding.

[0003] Further this invention concerns a three-piece can as well (claim 16), preferably a wall thereof, having an artifact embossed into that wall at a specific given artifact field place along the circumference and positioned at a specific (given) axial height.

[0004] Preferably cans are decorated by using paint, printing or leaving can walls blank. Specifically decorated walls are provided in an already printed version or decorated shape as flat blanks or sheets. They are stacked into a pile of decorated blanks that are released piece-by-piece, put onto a bed and forwarded by transporting rollers, to send them to shaping rollers that provide a cylindrical shape to each of the flat blanks. This cylindrical shape is open at both free vertical edges (both ends of the blank, converted to a cylinder) and will be transported further to a welding line, where an axial weld is provided to close the cylinder and provide the wall of a three-piece can.

[0005] It is an object of this invention, to provide an added decoration to the can that receives an additional shaping into the wall of the can and eventually supports or enhances a printing. This might have an aspect or visual appearance and it receives a 3-dimensional shape and enhances the attitude and appearance of a printed logo, a printed lettering (*Schriftzug*) or a picture that receives an additional 3-dimensional shaping. This further enables Braille writing and allows making use of writing on the can's wall for blind people.

[0006] The invention achieves this by using an embossing that is provided prior to the shaping. The embossing is not done into the closed cylinder, but it is done prior to preparing this flat sheet/blank into a cylindrical shape, thus it is positioned in the manufacturing line after (behind, downstream) placing the flat blank or sheet, printed or not printed prior to shaping, on the transport bed and prior (upstream) to the shaping rollers that are behind the transport bed. Putting the rotating embossing rollers here that provide the artifact, representing any type of in depth shaping, such as logo, writing, lettering, picture or any other decorating shape, will reduce detrimental effects on a manufacturing line. The additional embossing rollers can be placed here without altering

the whole transport and manufacturing line. Amendments or new configurations to this manufacturing line are reduced to a minimum. Specifically, the embossing rollers are placed behind the transport rollers, of which there are several pairs provided as groups (each group has an upper and a lower transport roller). After those transport rollers grip the flat blank, it is measurable in relation to its position on the bed by at least one encoder on at least one of the rollers and slip has minimized, if even no slip at all. It has a certain position and distance that is reducing towards the shaping rollers. Prior to those shaping rollers the embossing rollers receive the transported, flat blank (also called "sheet", in the following we use blank, although the blank might also have a decorated surface such as printing). This blank has a certain relative position towards a "central embossing point" between an upper and a lower embossing roller, which is called "embossing position/line".

[0007] The front edge of the transported blank decreases its distance from this embossing position that can be understood as a horizontal line, parallel to both axes of the upper and the lower embossing roller. At the time of meeting this transported flat blank, the embossing rollers have the same speed, at least substantially the same speed as the transported flat blank, to avoid slip-page (claim 1). Thus the transport rollers, the embossing rollers and the sheet/blank have the same speed at the surface of the blank. This during embossing the artifact into the blank (claim 1).

[0008] The surface speed concerns the circumferential speed of the transport rollers and the embossing rollers. Both touch the surface of the blank. Thus this surface has the same speed (longitudinal) as the circumferential speed of those mentioned rollers. As the surface is not separate from the blank, the whole blank has the speed of the surface.

[0009] Generally, those embossing rollers would be made of metal, both, the upper and the lower roller. The upper roller might have a protruding portion and the lower roller might have a depression, into which the protruding portion suitably fits during rotation at any time the upper protrusion and the lower depression meet. This usually is done by a gear transmission synchronization that keeps the relative position of both embossing rollers fixed.

[0010] The rotating embossing rollers that are geared together are driven by a "servo" (drive or motor) that has a control. This control provides a position control of the embossing rollers to fit to the position of the transported blank sheet.

[0011] To understand the effect of this position control, the protruding and depression portion of the embossing rollers has to fit or to register to a certain position on the transported blank. When a printed portion already exists, that is to be hit by the depression and protrusion, the axial position and a distance from the front edge are determined. Such both embossing portions of the embossing rollers have to fit to such an "artifact field" that is al-

ready printed on the sheet/blank. This is called an artifact position, field or a printed artifact that has to be met by the embossed artifact that is provided to the blank.

[0012] The embossed artifact will have a certain distance from the front edge of transported blank, and such the printed artifact also has this certain distance from the front edge.

[0013] With one and the same embossing rollers, the axial position (horizontally viewed) will not change, and such the control will register the circumferential position of the embossing portions of both rollers and the artifact field (or artifact position) on the flat blank. After having left the embossing rollers with the back edge of the blank, this blank is still flat and will then be transported by either a further transporting roller pair (upper and lower roller) or already by shaping rollers, which can functionally be treated as being transport rollers as well, having an additional function of preparing the cylindrical shaping of the still flat and transported sheet.

[0014] The control therefore provides that the embossing rollers have the same speed as the transported blank at the surface of the blank during the embossing taking place and may be somewhat earlier, when already gripping the front edge of the transported sheet with the embossing rollers. There might be a further circumferential space that corresponds to a lateral space from the weld edge (the front edge) of the sheet until the embossing field is reached, where the embossing portions of both embossing rollers are acting on the sheet.

[0015] This length position of the artifact in the sheet is determined by calculation and can be adjusted by controlling the circumferential position of the embossing portions of the rollers. Their rotation may also be corrected, when a control is designed as feed-forward-control providing the rollers already with a speed roughly identical to the transport speed of the blank and additionally providing a position control which corrects remaining differences. An inverter unit will provide energy to the motor and affect the control to register both embossing portions to correspond to the certain given position of the embossing field in the blank.

[0016] Best option to provide this control is a set value of a sensor that senses the leading edge of the transported sheet. This front edge detector will be at a certain distance from the embossing line (the line between the two embossing rollers) and calculation can take place what time is needed by a given speed of the blank, until the front edge will reach the embossing line or an embossing position (claim 3).

[0017] Best operated, the embossing rollers already have a speed that is a circumferential speed at the circumference being equal to the speed of the transported sheet, and the distance of the embossing portions (male portion and female portion) are in circumferential terms the same from the embossing line as is the front edge of the blank (measured by the sensor probe) from the same target, the embossing line between the rollers. The transport of the blank and the rotation of the rollers therefore

are already synchronous and will reach best registration. The further the embossing field is away from the front edge, the further away the male and female embossing portions have to be from the prior explained position that was aimed to make the embossing at the front blank edge. Usually, the front edge is free and not embossed and the embossing field is further upstream of the transported sheet and thus, the registration of the embossing portions of the rollers are also away from the "first time meeting position".

[0018] The control provides a correction, when this is not proper at the time of sensing the front edge of the blank. Having an encoder at the servo drive, this encoder enables exact measurement of the position of the embossing (male and female) portions of the rollers, such all control variables are measurable and can be adjusted in a system that provides a correction facility for each transported sheet to be embossed in his own embossing field.

[0019] Assuming, each blank is with its front edge spaced apart from the prior blank to have a certain own circumferential position correctly adjusted, thus, each front edge triggers a new control action to the servo motor driving the embossing rollers. Each sheet will be provided with an exact registration of embossing and eventually printed artifact field.

[0020] As mentioned, shaping takes place after embossing the artifact feature into the transported blank (claim 1,10).

[0021] Usually, it is best to have rubber rollers being on top and metallic rollers being below the transported sheet, to minimize slippage. Those rollers are kept synchronous by gear wheels axially spaced outside the transport bed. Best choice is to provide the front edge sensor between two spaced apart roller pairs (each upper and lower roller) to have a fixed position of the transported flat sheet relative to the roller circumference, prior to sensing its front edge (claim 2).

[0022] The edge control signal or referential signal that has a leading edge will be forwarded to the control section that can eventually adjust or correct the speed of the servo motor or drive to momentarily speed up or slow down the embossing rollers to allow the position to register to the position of the target, which is the printed artifact field. Still, the speed has to be the same again upon the front edge of the flat blank reaches the embossing position/line between the two embossing rollers.

[0023] The leading edge of the sensor signal can be used to calculate a time interval that is still available prior the front edge reaching this embossing position (claim 3).

[0024] As the transport rollers, at least one of them, might also have an encoder, the speed (and the position) of the blank is known to the control system and triggering the sensor or sensing the front edge of the transported sheet will allow, using the same speed, to calculate a time interval that is still available for the control to adopt the position of the embossing portions (male and female) in the embossing rollers. The edge detector might have

a detecting nose that is directed upwards and might operate on magnetic field influence or might as well operate optically.

[0025] Matching the target position (claim 4), thus adjusting the circumferential position of the embossing features takes place during rotation. Embossing rollers will not be stopped and accelerated for each blank transported, instead the embossing rollers will be driven with an assumed speed that is either calculated, generally assumed or measured from the speed of the transport rollers, to already have a speed and minimize control actions to the embossing rollers. Still, there might be positional adjustments necessary as each blank has a jitter with respect to the time instant at which the detector nose of the front edge sends the referential signal to the control.

[0026] The control actions are used to stabilize the system to avoid eventual mis-embossings. Each embossing that is slightly displaced from the embossing field will destroy this sheet for later use as cylindrical wall or can and thus, these mis-embossings have to be kept to a minimum.

[0027] Minimum scrap is one requirement, supplemented by a high speed that is required to minimize process delays. Thus, the embossing rollers have to rotate at high speed as well as the transport speed of the blanks and still each blank (sheet) has to be embossed at a certain instant and position, that is given by the artifact position that is already there on the blank (claim 5).

[0028] The tool that is able to make this high speed and minimized scrap and enhances artifact design has this mentioned embossing roller pair (claim 10, feature c). Embossing roller pair is driven by a servo motor/drive and the embossing roller is placed either behind the last transport roller or between the last and the penultimate transport roller group (each as an upper and a lower roller) to act on a still flat blank or sheet. The embossing roller pair is rotatable and each one, the upper and the lower has an embossing feature (one has a male feature, the other a female feature) to register at the position, where both rollers come closest together and have a distance that corresponds to the thickness of the sheet that is transported through this embossing line or embossing position (claim 3).

[0029] To make this registration safe and secure, the upper and the lower embossing roller are mechanically coupled, preferably by gear wheels provided axially outside at an end of each axis thereof (claim 15).

[0030] Prior to the embossing rollers, there are one or more groups of transport rollers, the upper one having rubber circumference and the lower having metal circumference. They are driven with a transport speed that is synchronous to the speed (circumferential speed) of the embossing rollers, still the servo drive makes the control of the embossing rollers independent from the speed of the transport rollers. All transport rollers thereby might be coupled together by belt drive or by gear wheels. Still, the embossing rollers are decoupled and electrically synchronized with the same speed by the servo drive that

provides this same speed by control.

[0031] The "same speed" might be altered by control that is triggered by the referential signal indicative of the front edge of a passing sheet and provided by a sheet detector. This feeding speed of the blank is provided to those blanks by the transport rollers. The speed controller provides same speed through the servo drive to the embossing rollers and thus, speed-coupling takes place electronically and not by belt-drive or gear wheels.

[0032] Both embossing rollers are permanently mechanically synchronized by gears (claim 15). They never lose their synchronization with respect to each other, to adopt the cooperation of the complementary embossing features.

[0033] The metal can has a cylindrical body having a height that is larger than a diameter thereof (claim 16). It might be produced by the tool (claim 10) or by the method (claim 1). It has the embossed artifact in the wall and this prior to having a weld or seam in axial direction connecting the free axially extending edges of the cylindrically shaped body wall. This can, when having a seamed top end and seamed bottom end might be an aerosol can, carrying the axially extending weld or seam. That joins the free edges of the cylindrically pre-shaped wall.

[0034] Usually, those cans are called three-piece cans and protection is to be conferred to the wall prior to welding, after welding and when being implemented into a finished metal can, having the cylindrical wall and a top cover and a bottom end seamed by double seam to the cylindrical wall.

[0035] Examples enhance the understanding of the invention as claimed. The examples that follow are true examples that are not meant to limit the invention and not meant to disclose "essential features missing from the claims", instead examples are provided to enhance the understanding of the claimed invention and serve for disclosure to the skilled man.

Fig. 1 is a lateral view onto a bed and a stack S of many flat blanks s, two groups of transport rollers 20,22 are present and a pair of embossing rollers 30 is shown thereafter. Not displayed, but by position indicated is a place of shaping rollers 26 that are turning the flat shape of the blanks s after being provided with the embossing feature into cylindrical pre-shapes, later on welded together at their free edges.

Fig. 2 is a more schematic representation of the position detection of the front edge s₁ of the transported sheet s having a distance y from the embossing position 33 between the embossing rollers 30.

Fig. 3 shows the object that is provided as aerosol can (left) and as uncoiled, flat blank (right) where four positions of embossing artifacts are shown. Not each of these four needs to be

present, one of them might be there and is shown in the left portion of the picture as a logo "impress" having both, writing and logo. Without writing or lettering, the initial "1"-logo might also be present as a sole artifact that needs enhancement by 3-dimensional shaping. In the flat blank (Fig. 3, right hand) the full embossing area is pointed out that can be used from the whole blank. A certain portion as edge rim portion is surrounding the rectangular full field into which embossings might be placed. Four certain fields are shown, one of which is 11a, receiving the 3-dimensional embossing 11 in a distance y_{11} from the front edge s_1 of the blank s . The length of the blank d substantially determines the diameter d of the finished can 15. The height h of the blank substantially determines the can height h (as shown left).

Fig. 4 is a control section 40 that is used in Fig. 1 to control the servo motor 38 (servo drive).

Fig. 5 is a schematic representation of the approach of a blank s to the embossing line 33 and schematically the upper (or lower) embossing roller 31a, carrying the female embossing feature 32a, to hit the embossing field 11a at the same speed v_s and at the embossing line 33.

[0036] Fig. 1 transports the flat blanks s from left to right. There is a feeder or hopper 18 that holds a stack S of many stacked sheets s , which are lowered by a lifting device 18a to the level of the bed 10. In the lateral view one blank s is positioned by a mechanically controlled rotation device 18b that lowers the lowest blank s with the lifting device 18a and places it on the bed 10. It is synchronized to the left by attaching it to a bar 18c with top lateral directing and piece. The blank's' has a front edge s_1 .

[0037] After this blank has been positioned on the bed 10, it will be moved forward to the first pair of transport rollers 20. They turn in opposite directions (top and bottom) and grip the front edge s_1 and the whole flat blank. It will be forwarded at transportation speed, implied to the blank s by the first transport rollers 20. This speed is above 150 m/min and up to 190 m/min. Then the transported blank s is also gripped by the second transport rollers 22, having top and bottom roller.

[0038] To synchronize the speed of the rollers and the speed v_s of the blank s , there is almost no slippage and this is supported by a top rubber roller and a bottom metal roller. They grip each transported (fed forwarded) sheet s and the speed at the outer surface of the metallic roller is the same as the speed of the transported sheet (metallic blank). The tinplate sheets (the blanks) may have a thickness of 0,18 mm to 0,20mm. Substantially thicker tinplate sheets have been examined of up to 0,5 mm and even 0,7 mm at reduced speed v_s of transportation.

[0039] To ensure measurement of this speed, no optical sensing is required, just a sensing of the rotation of one lower transport roller is measured by an encoder 17. This encoder is either coupled directly to the axis of the lower transport roller 22a or coupled to this by a transmission belt 16 that is not separately shown detail, just as a sketched link or connection.

[0040] All transport rollers 20,22,24 are coupled by gears or belts or gear belt to provide a lateral extending transport unit having same speed at all transport rollers along transport bed 10.

[0041] When the first transported sheet s is gripped by both transport rollers 20, 22, the next sheet is lowered from the stack S and also placed on the initial position of the bed 10 as shown in the drawing. Synchronizing sensor 18d and mechanical revolving motor provides an upwards and downwards movement of the fetching device 18a' (shown in dashed lines) and picking the lowest sheet s from the pile S and shown in continuous lines 18a when in the lowermost position on the top of the bed 10. When the blank has left this place and is forwarded to the initial transport rollers 20, the fetching device 18a will rise again and pick the next lowermost blank s from the pile S .

[0042] Further forward, towards the embossing rollers 30 having a top roller 31a and a bottom roller 31b, a sensor 50 is provided that is shown in more detail in Fig. 2. It may as well be placed directly behind the initial roller group 20. Such distance may be below 10 cm, 5 cm or 2,5 cm and between rollers 20,22.

[0043] This sensor 50 touches with its nose portion 51 the front edge s_1 of the incoming sheet s having the speed v_s . This sensing signal as leading edge 55a as shown in the time graphic is the initiation of the control cycle. It is sent to the control system 40 as signal 55. The rising edge (which could also be a falling edge) is called leading edge 55a. A duration of this pulse sensed by the nose 51 is the length of the sheet divided by the speed of the sheet.

[0044] The sensor 50 provides this signal 55 to the control system 40 that controls a servo drive (AC-motor) 38 which drives either the upper or the lower embossing roller 31a or 31b. Both embossing rollers are mechanically connected by a link that might be a gear-wheel link, allowing a continuous mechanical synchronization of upper and lower roller and a fixed coordination of the male protrusion 32b and the female indentation 32a provided as embossing features at a certain place of the circumference of both, the upper and the lower embossing rollers 31a, 31b, see Fig. 1 for such detail.

[0045] After the initial edge s_1 (the leading edge) of the blank s has passed the nose 51 of the sensor 50, which might be magnetically operated, there is a remaining distance Y_1 from the embossing position 33. This position is the minimum distance between the upper and lower embossing rollers and the place, where embossing should take place, when the printed artifact or the target position, when no printing is present on the sheet s , has reached this position of bed 10. The portion of this travel

is already shown in Fig. 1, after Fig. 2 has sent the leading edge 55a at time instant t_1 to the control system 40 as signal 55.

[0046] Taking the speed v_s as substantially constant during the travel of blank s from the position shown in Fig. 2 until the position reached slightly after shown in Fig. 1, when the front edge s_1 reaches the embossing point 33, and the distance Y_1 is fixed, the time T_1 can be calculated. Moving 50 to the left increases the time T_1 allowed to control registration of the embossing rollers 30.

[0047] The calculation is done by the control system 40, determining the angular position of both embossing features 32a, 32b from the embossing position 33. The angle α_2 as shown in Fig. 5 times the radius r_{31} of the upper roller 31a (and of course the lower roller 31b) gives the distance along the circumference that the embossing feature 32a (and corresponding embossing feature 32b for the lower roller 31b) has from the embossing point, position or line 33. This circumferential distance is $\alpha \cdot r_{31} / 360^\circ = x_2$.

[0048] This is the calculation for the front edge hitting the embossing point or line 33.

[0049] Usually, the embossing field 11a shown in Fig. 5 is not provided at the front edge s_1 but it is delayed or spaced to the back by the distance y_{11} . This field 11a is the place, where the embossing 32a/32b has to impact a transported sheet s with the same speed as the travel of the blank s to provide a clean 3-dimensional shaping into this field 11a. The control system 40 is provided and determines such exact pre-shaping into the flat device s traveling at the speed v_s .

[0050] In a first approximation, the speed v_{31} at the circumference of the upper roller 31a and the speed v_s are the same. The distance of both 11a and 32a from the embossing line 33 also is the same, when the control system 40 has corrected or adjusted the speed and position of the upper (and lower) embossing rollers 31a, 31b.

[0051] The embossing rollers 30 have a larger diameter than the transport rollers. Experiments have shown the larger rollers to be designed below 75 mm diameter being a good choice.

[0052] The larger y_2 in Fig. 5 is, the more spaced apart (in circumferential terms) the indentation 32a has to be provided from the line 33, assuming same speed v_{31} and v_s . When such distance is not the same in angular terms and in linear terms, the control needs to either speed-up shortly the upper and lower roller 31a, 31b, or needs to delay them for a moment, to adjust for a distance and on top of this provide a distance control as mentioned by making y_2 the same as x_2 . This is the ideal condition allowing both devices to approach the embossing line 33 at same speed. When the embossing rollers 31a and 31b grip the front edge s_1 , the embossing indentation 32a (and correspondingly the embossing protrusion 32b, not shown in Fig. 5, but displayed in Fig. 1) have a distance from this embossing line 33 that corresponds to y_{11} , but

on the outer circumferential surface of the embossing rollers 30.

[0053] The embossing action is - after gripping the blank s - delayed as far as a distance y_{11} reaches from the front edge s_1 and after embossing, the blank is further moved through a slit between the two embossing rollers to be sent to another transport roller group 24 (not shown in Fig. 1) and a further downstream shaping rollers 26, not shown in Fig. 1, but displayed in its position.

[0054] The servo drive 38 is driving the upper embossing roller 31a in Fig. 1. The embossing rollers are linked or connected by a gear-wheeled system 39, shown schematically only.

[0055] Buttons 48 give basic functions in the control section 40. A display 49 displays machine data and system data on a screen, to visualize the operating and the function of the control system 40 for the embossing rollers.

[0056] To make the time T_1 that is available for the registering (or synchronizing) action as long as possible, the front edge detector 50 should be placed as close as possible behind the first transport roller group 20. Thus the blank is already registered with the rotation speed of the transport rollers, and a rotational encoder may provide reliable position data of advancing each blank s . The rotational encoder is coupled to either one of their axes or a belt drive connecting the axes of those transport rollers.

[0057] The control system is in more detail displayed in Fig. 4.

[0058] Two PI-controllers are connected in series. One is the position control 41 and the other one is a speed control. The speed control 42 controls a thyristor, IGBT- or transistor inverter 43 that drives an AC-servo motor 38, linked by either gear or direct drive to the upper roller 31a.

[0059] In an initial or set value y_2 is provided to the PI-controller 41 that is the position control. The position controller 41 might as well be a proportional controller.

[0060] The set value is provided as y -value. y is y_2 as shown in Fig. 5 as the distance of the embossing field 11a, where the embossing artifact has to be placed, from the embossing line 33. The control for the servo drive 38 provides that x_2 has the same value. The control also provides that the speed of the outer surface of the roller 31a and the speed of the blank s is the same.

[0061] The front edge s_1 has a distance y_1 and added to this is the distance y_{11} of the embossing field 11a from the front edge s_1 , both making up the distance y_2 which is the set value for the position control 41 in the system control 40.

[0062] As the speed will naturally be given by the position controller 41, when being a controller having integral component, as output of the controller 41, it can be assumed that this speed v_s will be the same as v_{31} , and thus a pilot signal (feed-forward-control) may be implemented, supplying the output of the position control with an added value of v_s . Thus, the controlling component

or the compensating component from controller 41 needs to be small and may be reduced to zero, when the relative position is correct of roller and sheet and the speed is the same for roller 31a and blank s.

[0063] Other controllers may be employed, PI-controllers are shown for easy reference and one example of providing an error-free control for speed (used for producing zero slip upon touching the blank s with the embossing roller 31a/31b) and for reducing any deviation from the embossing field 11a as zero positional error for a moving target. Controller 42 might be of PID-type, controller 41 might be of P-type.

[0064] The result is displayed in Fig. 3. Fig. 3 has an uncoiled wall of the three-piece can 15, having the embossing feature 11 provided in the wall. This embossing feature is mainly a logo l with an oval slanted shape and added to it a writing that is continuing in axial direction. In this example, the embossing has to be a plain indentation as additional artifact on the can, which can be read by touching similar to Braille writing. Blind people might read the can's outer surface.

[0065] When printing is provided earlier on the flat blank s as shown in the right hand part of Fig. 3, the printed area may contain the same shape in printed color as it will receive embossed. Thus, the embossing has to fully and precisely register with the printed artifact. This is the target position when a printed artifact is already provided in a printed decoration of the flat sheet. It is however to be mentioned, that colored decoration is not a requirement to provide a precise positioning of the embossed artifact. This can as well be provided on a metallic surface, not decorated by writing or it can be provided on a colored, already printed surface that has no specific writing in it, where the embossing has to be placed.

[0066] The distance y_{11} as seen in Fig. 3 is as shown and explained in Fig. 5. This embossing field 11a is initially a central Impress-logo-writing in the left end of the field 12. This field 12 marks the places, where the tool and with it the method that is disclosed, can provide embossing features. It can be spaced upward and downward and it can be spaced forward and backward, leaving an edge rim of small size, completing the full blank s that is a flat sheet of may be tinplate.

[0067] As seen in Fig. 3, other distances y_{12} can be provided and other axial positions, when viewed along the can height h in the left portion of Fig. 3 can be provided as well. For this, the rollers 31a, 31b have to be replaced with other rollers that carry their embossing feature 32a, 32b at a different axial position (along the width of the bed 10). By control, the position from left to right in Fig. 3 can be amended, changed, adapted or modified according to customer's orders. This is done by changing the set value of the control and changing the value y_2 in Fig. 5 given a set value y to the control system 40.

[0068] One other field 11a" for embossing is provided in the right end of the embossing area 12 and is open for placing embossed feature 11". Distance y_{11} is substantially larger than for reaching the embossing field 11a.

[0069] The other axial modified embossing fields 11a' and 11a" can be seen in Fig. 3, embossing field 11a' has distance y_{12} .

[0070] After shaping the embossed flat blank s with shaping rollers 26, the cylindrical wall s^* is provided that is used to make up the can as three-piece can as shown in Fig. 3, left portion. The diameter d is substantially the length of the blank and the height h of the can 15 is substantially the width of the blank s.

[0071] An outside bulged top end (cover) is seamed to the top edge of the cylindrical wall and a bottom end (closing piece) is seamed to the bottom edge of the cylindrical wall s^* . A pressure operated valve may be placed into a central opening of the top bulged cover.

Claims

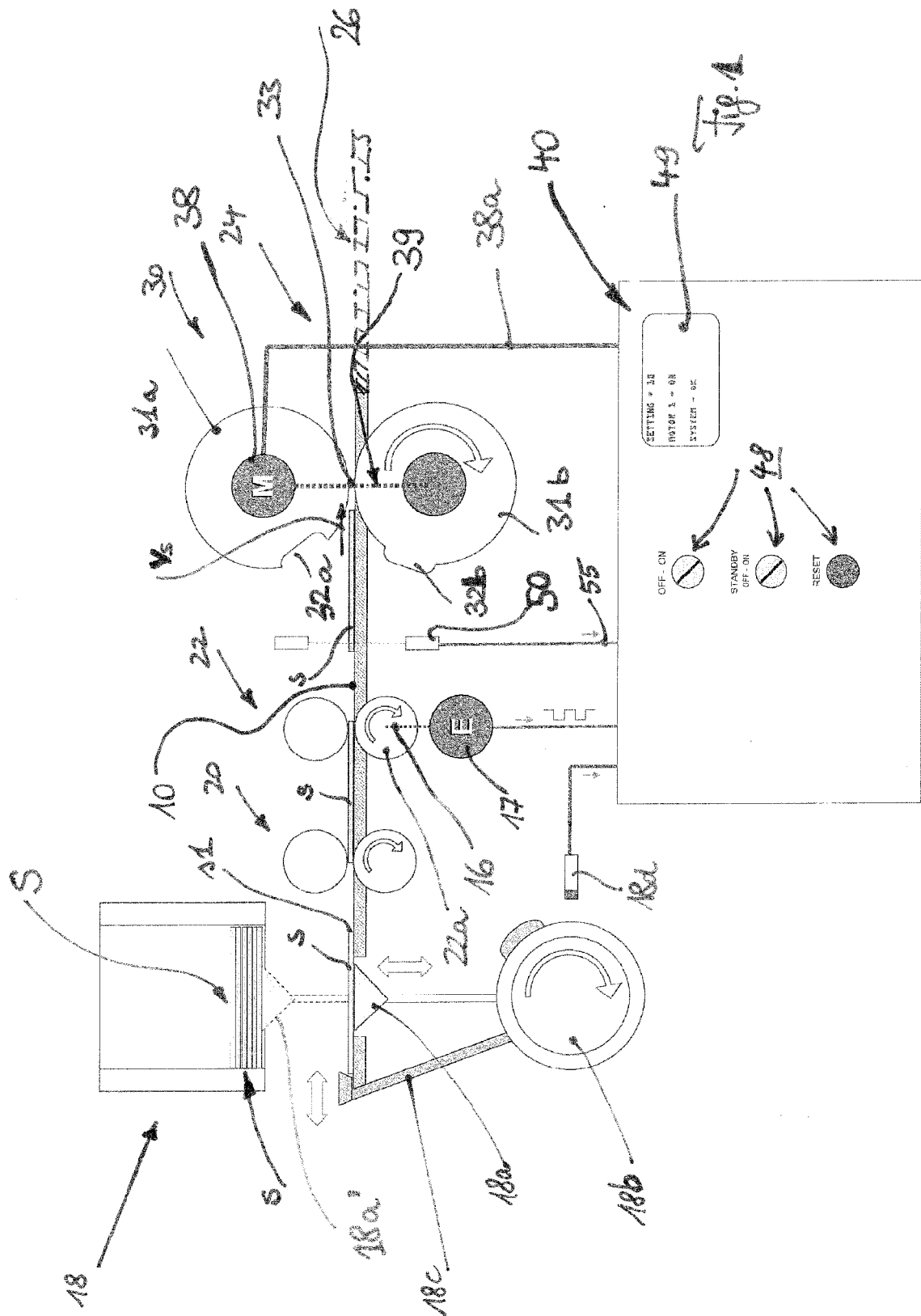
1. Method of embossing an artifact (11,11') into a wall of a can, preferably an aerosol, paint or other three-piece can (10), wherein

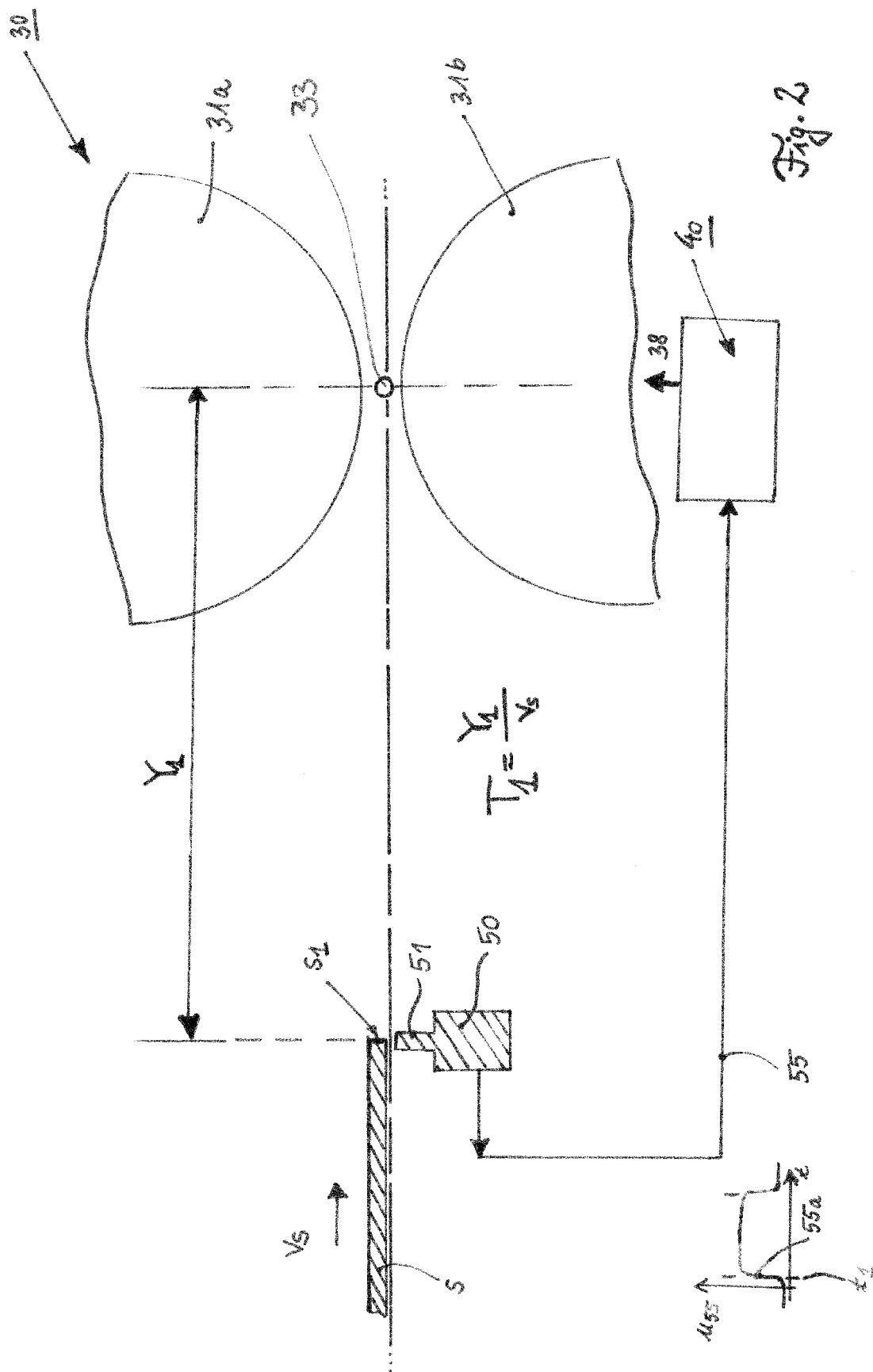
- (a) a flat sheet or blank of metal (s) is transported (v_s) along a transport bed (10) by several spaced apart groups of rollers (20,22,24), each having a top and a bottom roller (20a,20b;...);
- (b) a rotating embossing roller pair (30;31a;31b), provided between two of the groups of transport rollers (22,24), and driven by a servo drive or motor (38), embosses (32a,32b) the artifact (11,11') into the flat, transported sheet or blank (s);
- (c) whereby the transport rollers at their surfaces, the embossing rollers at their surfaces, and the sheet or blank have the same speed (v_s) during embossing the artifact (11,11') into the blank or sheet, and a length position (y_{11},y_{12}) of the artifact in the sheet or blank is determined, adjusted or corrected by a speed and position control (40) of the servo drive (38), driving the embossing roller pair (30);
- (d) shaping (26) a cylindrical base shape (s^*) of the can wall (15).

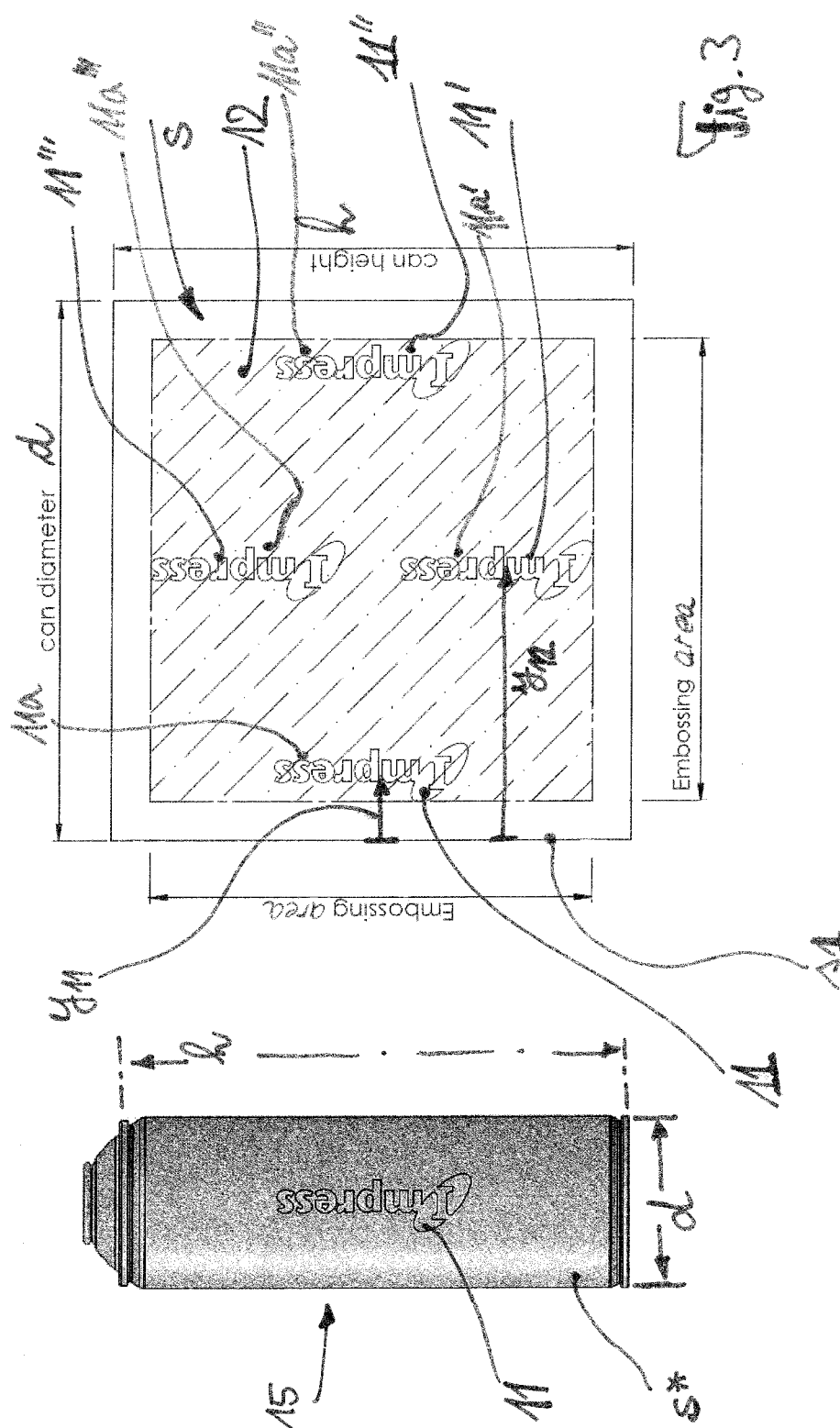
2. Method of claim 1, wherein a front edge detector (50,51), placed along a path of travel of the sheet or blank (s), provides the speed and position control (40) with a referential signal (55,55a), representing a passing of the front edge (s_1) and a remaining time interval (T_1), until an embossing line or position (33) between the embossing rollers (30) is reached by the front edge (s_1) of the sheet/blank.

3. Method of claim 2, wherein the time interval (T_1) is calculated using a distance (Y_1) between a front edge detector nose (51) and the embossing position (33).

4. Method of one of prior claims, wherein the speed and position control (40) adjust a circumferential position (x_2) of an embossing feature pair (32a,32b) in the embossing roller pair (30) during rotation, to match a target position (11a,11a') on the sheet/blank (s), where ($y_2:y_{11},y_{12}$) the embossing takes place and the artifact (11,11') is embossed. 5
5. Method of one of prior claims, the sheet or blank having a printed surface and a target position where a printed artifact (11a,11a') is provided that is to be met by the embossed artifact (11,11'). 10
6. Method of claim 4, the target position as embossing field having distance (y_{11}) from the front edge (s_1). 15
7. Method of claim 4, the control system (40) as speed and position control having at least one PI-controller (41,42). 20
8. Method of one of prior claims, the servo drive (38) being an AC-motor.
9. Method of one of prior claims, the top and bottom embossing rollers (31a,31b) being rotatably linked by a gear-wheeled coupling (39). 25
10. **Tool for embossing** an artifact (11,11') into a wall of a three-piece-can (15), the tool having 30
 - (a) several groups of transport rollers (20,22,24), each having top and bottom roller;
 - (b) a rotatable embossing roller pair (30), having embossing features (32a,32b) at a certain position in their outer surface, and being mechanically coupled with a servo motor or drive (38); 35
 - (c) the embossing roller pair (30), and the servo (38) placed between the last (24) and the one prior to the last transport roller group (22), to act on flat blanks or sheets (s); 40
 - (d) a controller (40) for controlling the servo (38) and receiving a referential signal (55,55a), indicative of a front edge (s_1), each of the flat blank/sheet passing a sheet detector (50) with a feeding speed (v_s), implied to the blank/sheet by the transport rollers (20,22,24). 45
11. Tool of claim 10, a speed coupling (as rotational speed) of the transport rollers (20,22,24) are provided by a mechanical link, such as gear wheels, belt, toothed belt, and a corresponding speed coupling to the embossing rollers (30) is done by control (40) and implied by the servo drive or motor (38). 50
12. Tool of claim 11, a speed of the embossing rollers (30) is allowed or even forced to change as compared to the transport rollers (20,22,24), to adjust for positional deviations (y_2,x_2), preferably the controller (40;41,42) comprising at least a speed controller (41). 55
13. Tool of one of prior tool claims, a diameter of each embossing roller (30) being larger than a diameter of each transport roller (20,22,24).
14. Tool of claim 10, a distance of the sheet detector (50,51) from the first transport roller group (20) being less than 10 cm, preferably less than 5 cm or less than about 2,5 cm.
15. Tool of claim 10, the embossing roller pair (30) is linked or connected by a gear-wheeled system (39).
16. **Metal can** having a cylindrical body and a height, larger than a diameter thereof, and having a body wall (15), manufactured according to one of claims 1 to 9, or manufactured with a tool of one of claims claim 10 to 15.
17. Metal can of claim 16, being an aerosol can having an axially extending weld/seam joining free edges of the cylindrically pre-shaped wall (15), to form the body of the aerosol can.
18. Metal can of claim 16, being a three-piece can, with top end, cylindrical wall and bottom end.







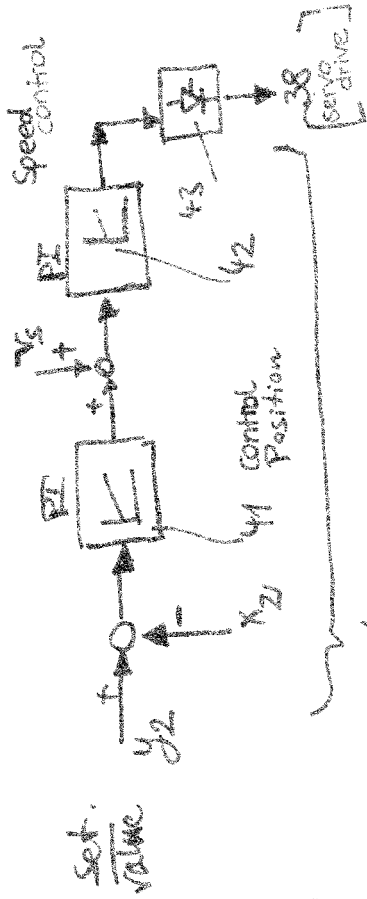


Fig. 4

$$y_2 = \alpha_2 \cdot \tilde{y}_1 / 360^\circ = x_2$$

ideal = $y_2 = x_2$ unless
embossing.

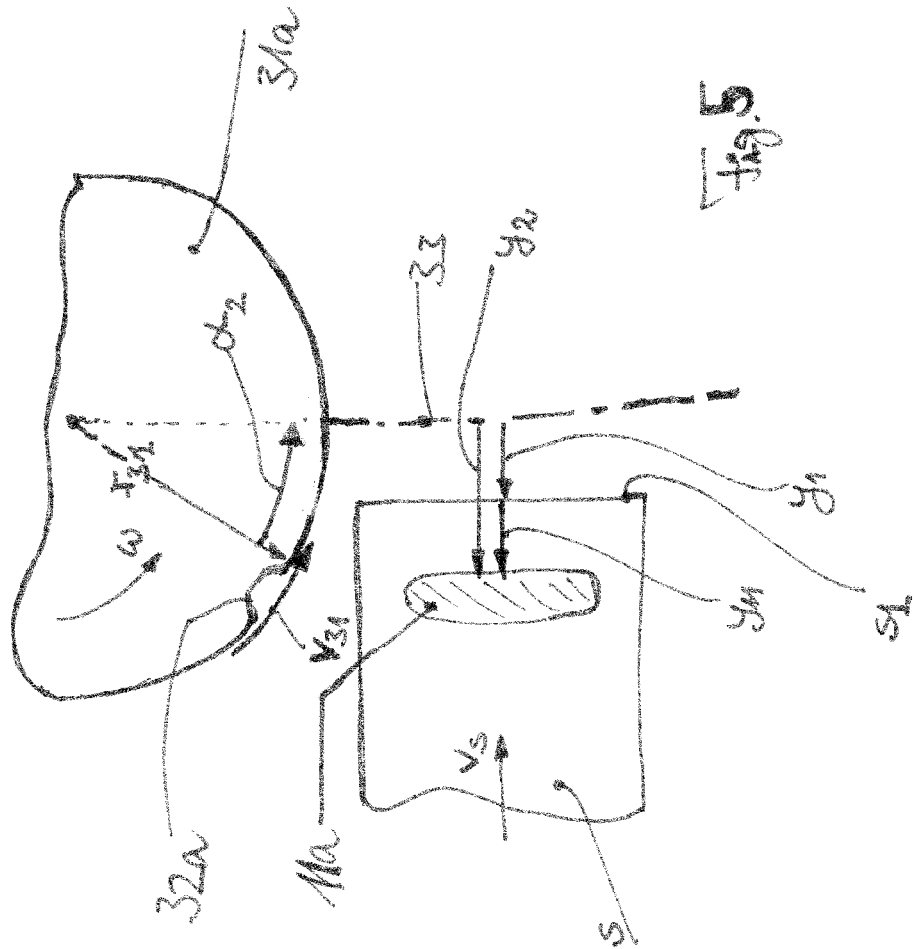


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 12 18 4555

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 11 June 2013	Examiner Sartor, Michele
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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