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(54) **METHOD AND DEVICE FOR OILING STRIP MATERIAL**

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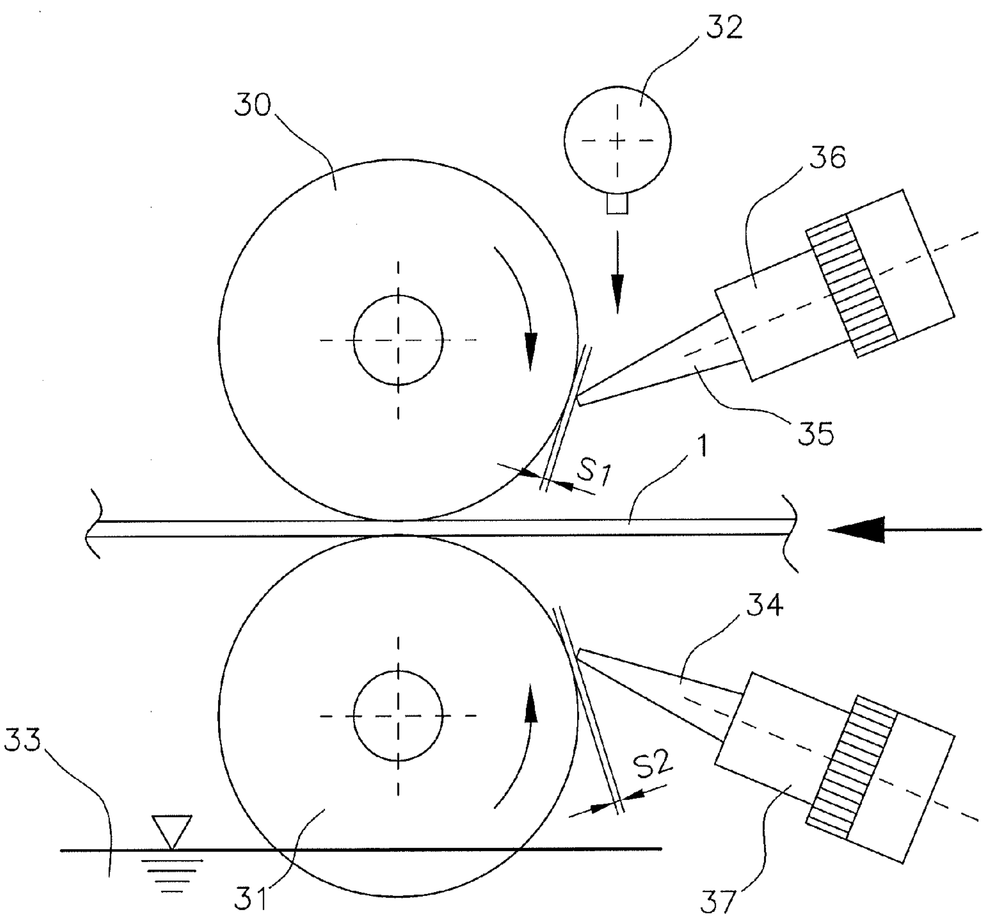
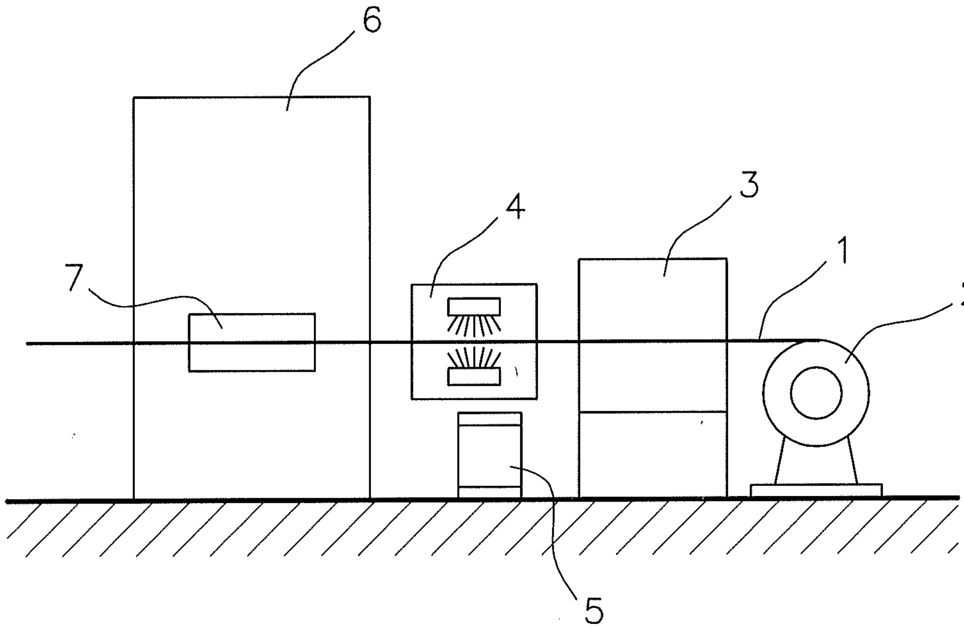
(57) **ABSTRACT**

A device for oiling strip-shaped material (strip material) includes at least one application roller which rotates in a running direction of the strip material that applies oil to the strip material, an apparatus that coats a lateral surface of the application roller with oil and a dosing device that adjusts thickness of the oil layer on the application roller.





(PRIOR ART)

Fig. 1

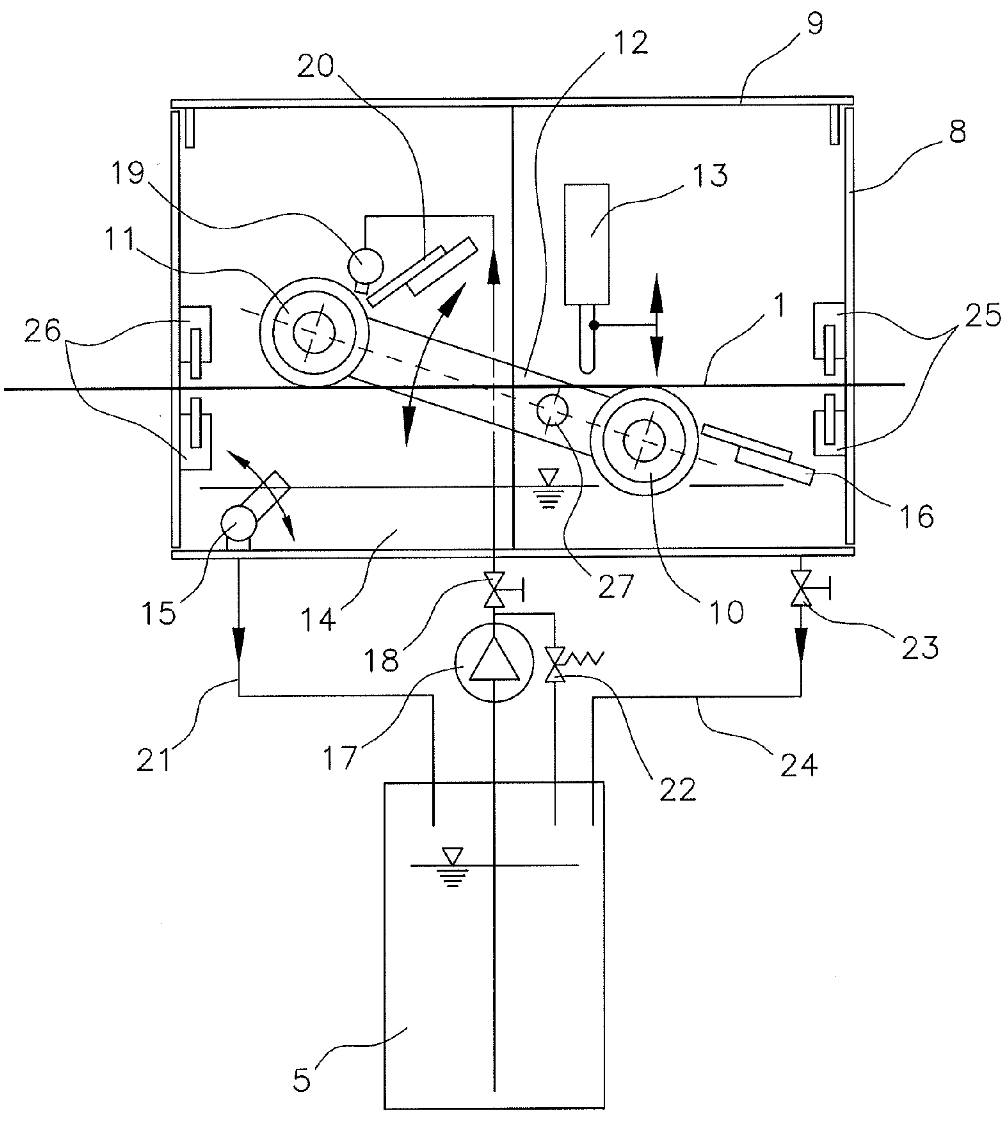


Fig. 2

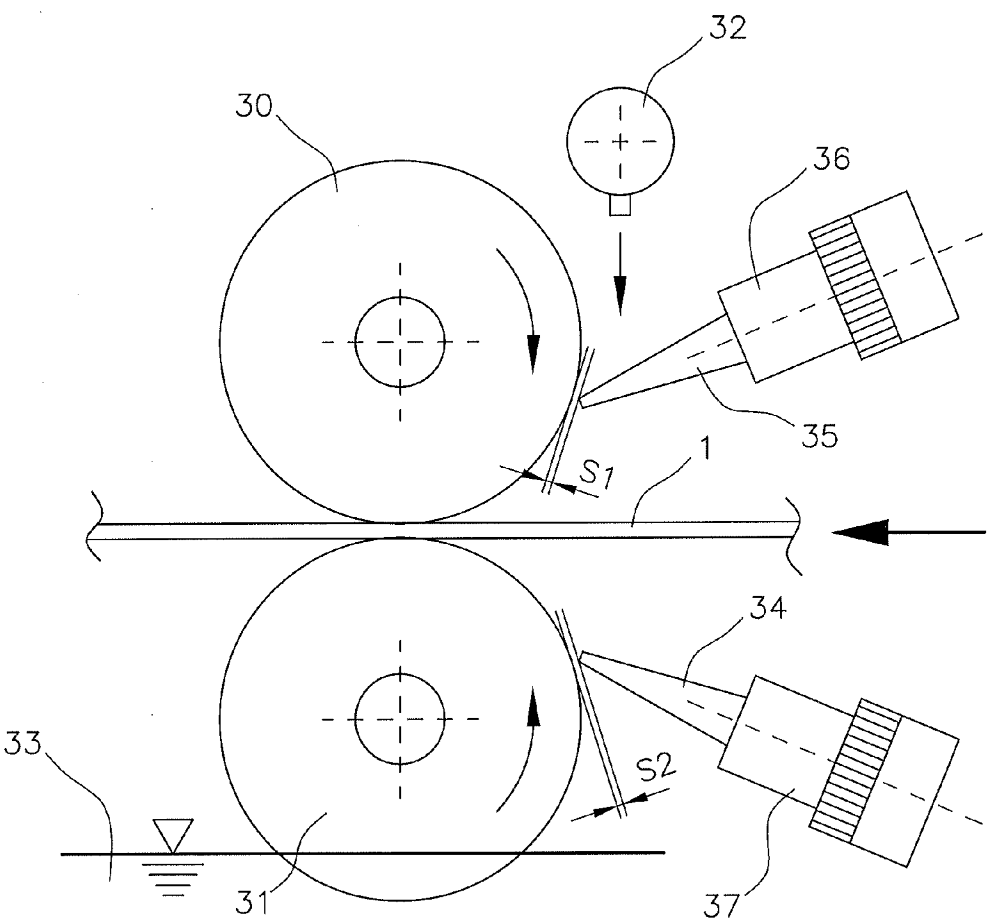


Fig. 3

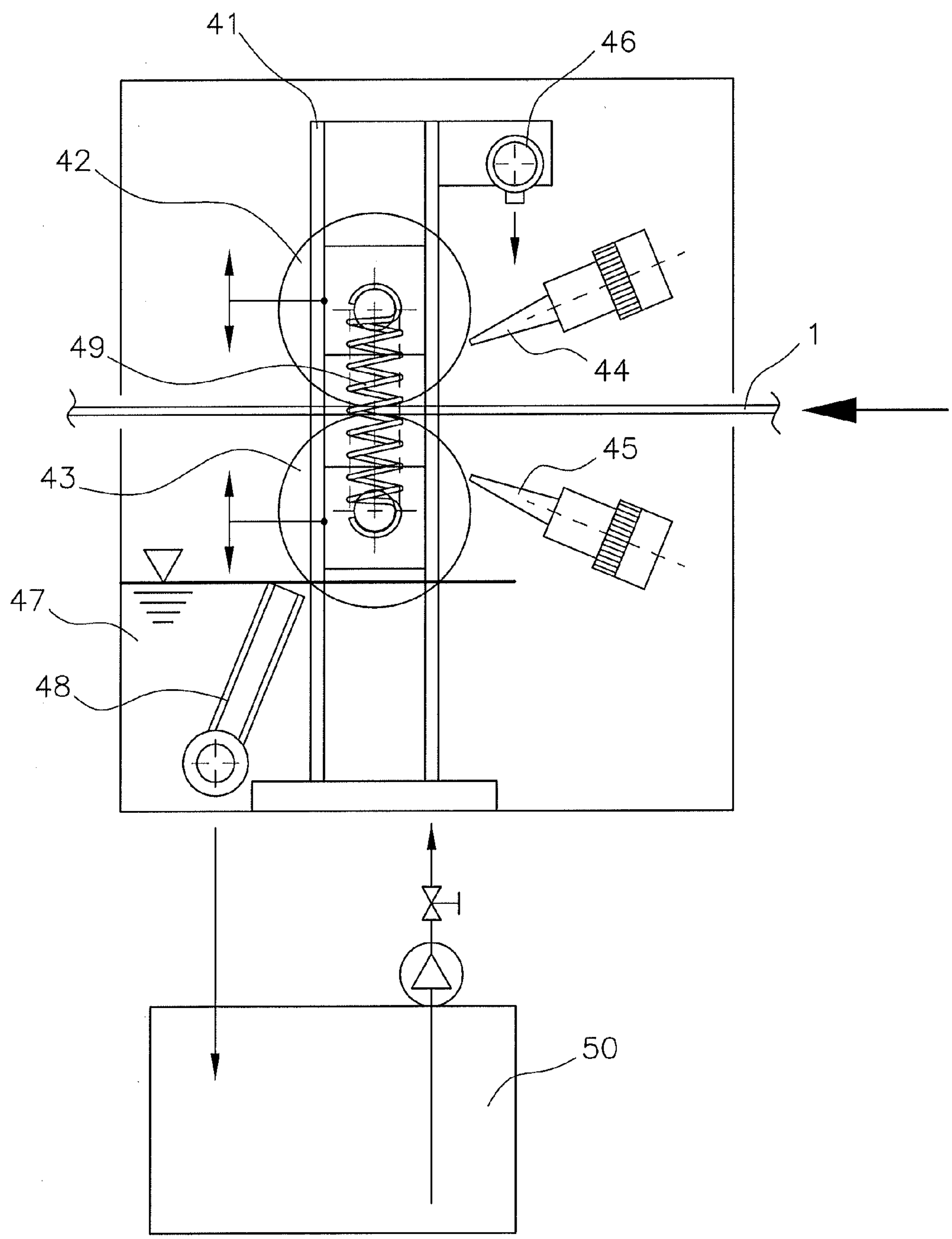


Fig. 4

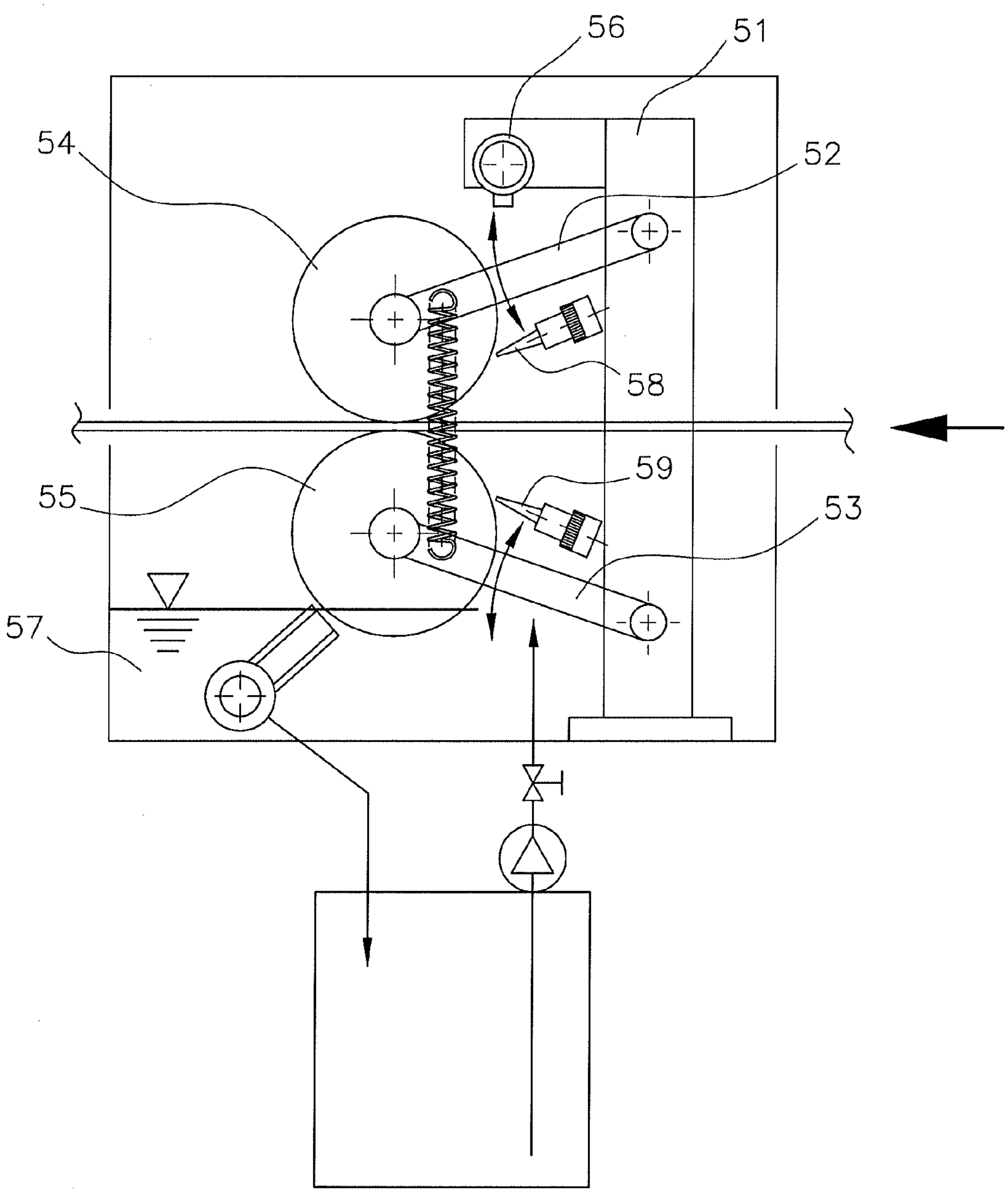


Fig. 5

METHOD AND DEVICE FOR OILING STRIP MATERIAL

TECHNICAL FIELD

[0001] This disclosure relates to a method and a device for oiling of preferably strip-shaped material (strip material), in particular, punching strips.

BACKGROUND

[0002] Generally, with punching (die cutting) and mechanical forming processes there is need to oil the in general strip-shaped basic- material (strip material), like punching strips, to reduce wear of the employed tools, like the blank holder, upper knife (punching die), lower knife and cutting die (matrix), for example. In general, the oil is applied prior to entry into the respective tool.

[0003] The term "oiling" is meant to describe not only the application of pure oils, like mineral oils (petroleum, based oils) exclusively composed of hydrocarbons, for example. Indeed, the term "oiling" is to be given a broad interpretation. A more general application of liquid agents exhibiting lubricating characteristics is to be covered thereby, for example, also of liquefied fats and waxes, oily emulsions, or solutions and/or suspensions of inorganic or polymeric lubricants. An accordingly broad interpretation is to be given to the term "oil". In particular, all liquid agents having lubricating characteristics are be covered thereby that will be employed for lubricating during punching and mechanical forming processes.

[0004] The schematic sequence of such a process is illustrated in FIG. **1**. A strip (**1**) to be oiled is reeled from a coil (**2**) and guided through an adjustment unit (**3**). In the feeding zone of a punching machine and/or mechanical forming machine (**6**) is disposed a device (**4**), wherein the oiling of the strip (**1**) is effected. The oil is transferred from a storage container (**5**) to the device (**4**), and there applied onto the strip (**1**). Subsequently, the strip is processed by the tool (**7**) in the punching machine and/or mechanical forming machine (**6**). This processing comprises a punching procedure and/or a forming procedure.

[0005] Typically, spray devices or rolls with felt-coated rollers are used to oil strip material. However, both approaches have drawbacks. In a spraying process, the amount of oil applied to the strip material is affected by the viscosity of the oil, the overlapping of the spray cones and the spraying pressure. Accordingly, the amount of oil to be applied is difficult to control. Furthermore, finely atomized oil droplets are generated during spraying and are tedious to be drawn off or separated. Indeed, by using an electrostatic oil droplet transfer, the oiling conditions may be improved, but laborious drawing off cannot be avoided thereby. Furthermore, the technical equipment involved with the electrostatics is very expensive. Even roll cladding of the oil using felt-coated rollers, in general provided with oil pressure from inside, achieves Unsatisfactory results since the amount of oil retained in the felt rollers is difficult to control and transfer to the strip surfaces is affected by the contact pressure of the felt rollers. Application of a very fine, uniformly distributed oil film is very difficult to accomplish. In particular with an intermittent advancement (typical with punching processes), oil pools are likely to arise on the punching strips during work cycle breaks. To prevent this, a deliberately smaller oil feeding has to be used. However, there is a risk of the punching strip partially running dry so that cases of process malfunctioning up to tool failures may occur.

[0006] It could therefore be helpful to provide a procedure for oiling strip material, wherein the described problems will not occur or merely to a minor extent. It could particularly be helpful to apply an oil film uniformly onto strip material such as punching strips and, namely, most independent of the advancement rate and period of work cycle breaks during intermittent advancement.

SUMMARY

[0007] I provide a device for oiling strip-shaped material (strip material) including at least one application roller which rotates in a running direction of the strip material that applies oil to the strip material an apparatus that coats a lateral surface of the application roller with oil and a dosing device that adjusts thickness of the oil layer on the application roller.

[0008] I also provide a method of oiling strip-shaped material (strip material) including applying oil to the strip material with at least one application roller which rotates in the running direction of the strip material and coating the application roller with oil with the aid of an apparatus that coats a lateral surface of the application roller and adjusting thickness of the oil layer on the application roller with a dosing device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. **1** shows a device for oiling of punching strips according to the prior art;

[0010] FIG. **2** shows a first exemplary embodiment of a device for oiling of punching strips;

[0011] FIG. **3** shows a main functional group of a device for oiling of punching strips according to a second exemplary embodiment;

[0012] FIG. **4** shows a first embodiment of a device for oiling of punching strips including a main functional group according to FIG. **3**; and

[0013] FIG. **5** shows a second embodiment of a device for oiling of punching strips including a main functional group according to FIG. **3**.

DETAILED DESCRIPTION

[0014] I provide devices adapted to applying liquid coating materials onto substrates. In particular the device is for oiling preferably strip-shaped substrates (strip material), in particular punching strips. The strip material to be oiled is typically guided through the device by a drive mechanism and by using pulleys. The device always comprises the following components:

- **[0015]** an application roller, which rotates in the running direction of the strip material to apply oil to the strip material,
- **[0016]** an apparatus that coats the lateral surface of the application roller with oil, and
- **[0017]** a dosing device that adjusts the thickness of the oil layer on the application roller.

[0018] In contrast to the above-described oiling of strip material with the aid of felt-coated rollers, my devices allow improved control of the amount of oil to be applied. On the one hand, oil is applied to the exterior of the lateral surface of the roller and, thus, directly to the roller, and not via a detour passing the interior of the roller and the felt coating, on the other hand, the thickness of the oil layer on the application roller can be adjusted directly by the dosing device and not only controlled by way of the replenish flow of oil.

[0019] The amount of oil to he applied to the strip material is generated contactless in the form of an oil layer of defined thickness on the lateral surface of the application roller with the aid of the dosing device, and transferred to the moving strip material by the application roller. The transferred amount of oil is completely independent of the advancing rate of the strip material. However, the amount of oil can be adjusted by the dosing devices. This will be discussed in more detail below.

[0020] If only a one-sided oiling of the strip material is to be effected, there is in general not more than one application roller needed. However, particularly preferred is that the devices comprise:

- **[0021]** a first application roller which rotates in the running direction of the strip material that oils the bottom surface of the strip material (also designated bottom roller), and
- **[0022]** a second application roller which rotates in the running direction of the strip material that oils the top surface of the strip material (also designated top roller),

wherein each of the application rollers is assigned an apparatus for coating the lateral surface of the application roller with oil and a dosing device that adjusts the thickness of the oil layer on the application roller. Thus, the strip material can be oiled on both sides in one passage cycle.

[0023] There are a plurality of variations on how the two rollers may be arranged relative to one another in the devices. On the one hand, both application rollers can be disposed in an offset position relative to another in the running direction of the strip material (variation A). On the other hand, the rollers can form a gap, with the height of the gap corresponding approximately to the thickness of the supplied strip material (variation B).

[0024] In particular with variation B, it is preferred that at least one of the application rollers, in particular the top roller, is movably supported perpendicular to the running direction of the strip material. This allows fixing the bottom roller on a predetermined level or position, while the top roller is movably supported and placed on the bottom roller. Depending on the weight of the top roller, a more or less important pressure is exerted thereby on the bottom roller and also on strip material fed through the gap between the rollers, as the case may be.

[0025] It may be preferred that the two application rollers are coupled to one another by an elastic control element, for example, a spring with adjustable spring stiffness. This case allows for specific adjustment of the contact pressure on strip material fed through the gap between the rollers using the control element and, optionally, also allows for adaptation during operation.

[0026] Preferably, the devices are characterized in that the two application rollers are disposed on the opposite arms of a double-acting lever (also referred to as rocker in the following rocker) rotatably or pivotably supported on a pivot or a pivoting axis, respectively. Thereby, an offset arrangement of the application rollers in the running direction of the strip material is feasible (variation A). Preferably, the pivoting axis extends parallel to the axis of the application rollers.

[0027] In these examples, the lever and the application rollers are preferably configured and arranged such that one of the two application rollers exerts pressure on the top side and the other roller exerts pressure on the bottom side of the strip material to be oiled. Preferably, the first application roller exerts pressure on the bottom side and the second application roller exerts pressure on the top side of the strip material to be oiled. Particularly preferred is that the pressure is effected exclusively by the force of gravity acting on the application rollers and the lever.

[0028] This is accomplished in a very simple manner, namely in that, for example, the lever arm, in short the arm on which the second application roller is disposed, is longer than the arm for the first application roller. As an alternative or in addition, the second arm or the second application roller can, for example, be loaded by weights and/or made of materials differing in density (e. g. the second application roller can be made of steel and the first application roller made of comparatively light-weight aluminum). By variation the these weights or materials, or by adjusting the arm lengths or the distances of the application roller to the pivot and the ratio of the distance of the first application roller from the pivot to the distance of the second application roller from the pivot, respectively, the pressure exerted by the application rollers on the strip material can be adjusted precisely.

[0029] Of course, even with variation A, the rollers may he coupled to one another using an elastic control element, like the above mentioned spring.

[0030] The devices can include a single lever as well as a double lever for the double-acting lever. As a double lever, the double-acting lever comprises preferably two single levers of identical length and identical leverage ratios, arranged to be rotating or pivoting around the same pivot or the same pivot axis, respectively, and with the first and the second application rollers rotatingly supported there between.

[0031] Preferably, the application rollers of the devices contact the strip material in a force-fit manner so that the rollers can roll uniformly on the strip material during the oiling procedure.

[0032] Preferred is that application rollers have a lateral surface (surface shell) made of synthetic material, metallic material, ceramics, or composite material. Eligible synthetic materials are, for example, all elastomers exhibiting chemical resistance to the medium to be applied, an eligible metallic material is in particular steel.

[0033] The lateral surfaces as such may have a surface structure adapted to improve adhesion and/or retention of oil on the surface. Preferably, the lateral surfaces have a dimple pattern. A dimple structure is a surface structure, wherein small depressions, so-called "dimples," are included to retain the oil. The dimples are also referred to as "pockets."

[0034] As a dosing device to adjust the thickness of the oil layer, a coating knife or a coating roller are preferably used. As an alternative or in addition, one or more plain strippers, for example, made of synthetic material can be provided. In particular, using a coating knife or a coating roller allows exact adjustment of the amount of oil transferred to the strip material. To that end, advantageously the coating knife is supported variably relative to the associated application roller so that a gap width between the lateral surface of the application roller and the coating knife is adjustable to a desired value. In the case of differing oil layer demand in the direction transverse to the strip material, the employment of dimensionally offset coating knives is possible as an alternative or in addition. This feature is also not feasible with the above discussed previous methods.

[0035] My novel methods have decisive advantages in view of minimum quantity oiling, and this was not possible to date.

Minimum quantity lubrication allows optimum results in high-speed die cutting or punching.

[0036] As an apparatus for coating the lateral surface of the application rollers, the top roller may, for example, have an oil pressurized manifold. The bottom roller may, for example, have an oil bath, where the bottom roller is immersed. Of course, another option would be to spray the oil onto the rollers, or to transfer the oil from an upstream dosing roller to the application rollers.

[0037] With the method for oiling strip material, oil is applied to the strip material by at least one application roller, which rotates in the running direction of the strip material. The application roller as such is coated with oil using an apparatus for coating the lateral surface. With a dosing device, the thickness of the oil layer on the application roller is adjusted. In an example, the dosing device includes a coating knife, wherein the distance of the coating knife to the lateral surface is varied to adjust the thickness of the oil layer.

[0038] The devices are particularly well adapted to performing the methods.

[0039] In this context, emphasis is placed on the fact that the methods not mandatorily have to be in line with a mechanical forming process, like a die cutting procedure. For example, the methods can be used to apply corrosion preventor (an oil including corrosion preventive inhibitors, for example) to a preferably strip-shaped substrate.

[0040] Further features will become apparent from the following description of a preferred example. In this context, explicit emphasis is placed on the fact that all the facultative aspects of the devices and the methods as described herein, can in each case be implemented on their own or in combination of one or more of the other facultative aspects as described in an example. The description below of the preferred examples is merely for illustration and better understanding and is in no way to be interpreted as limiting.

[0041] FIG. **2** shows a diagrammatic two-dimensional view of an example of a device for oiling punching strips including two application rollers in an offset arrangement (variation A). This arrangement comprises a housing (**8**). A punching strip (**1**) is fed into the housing via a slot. Upon completed oiling, the punching strip (**1**) is led out of the housing via another slot (running direction from right to left). For convenient accessibility, the housing (**8**) may have a removable cover (**9**). Two application rollers (**10** and **11**) located on a rocker (**12**) touch the punching strip (**1**) in a force-fit manner from below and above so that the application rollers (**10** and **11**) roll off steadily on the punching strip (**1**) due to the longitudinal movement thereof. The rocker (**12**) is rotatingly supported such that the rocker lever in the running zone is longer and thus presses the application roller (**10**) from below and the application roller (**11**) from above onto the punching strip (**1**) according to the force of gravity. To facilitate passing of the punching strip (**1**) between the two application rollers (**10** and **11**), a manually or automatically operable lever (**13**) may be provided to press against the rocker lever and disengage the application rollers (**10** and **11**). The lever can be actuated by pressurized air or hydraulics, for example. The lower portion of the housing (**8**) is filled with oil (**14**). The level of the oil filling is adjusted by a pivotable filling level nozzle (**15**). Excess oil can be returned into the reservoir (**5**) via a drain (**21**). The level of oil is preferably selected such that the application roller (**10**) is immersed so deep into the oil that good wetting of the roller surface is achieved. Excess oil on the roller surface is wiped off using an adjustable coating knife (**16**) so that subsequently only a desired amount of oil is transferred to the punching strip (**1**) by rolling off.

[0042] The application roller (**11**) resting on the punching strip (**1**) is drizzled with oil by a distributor tube (**19**). The excess oil is wiped off using an adjustable coating knife (**20**), whereby the desired oil wetting of the punching strip (**1**) on the surface is obtained. The excess oil is returned to the reservoir via the drain (**21**) and the filling level nozzle (**15**). The lateral surfaces of the application rollers (**10** and **11**) are particularly preferred to be made of either an elastomer or hard chrome plated steel exhibiting a dimple pattern, as mentioned above. The depth of the dimples is affected by the viscosity of the oil and the desired amount of oil to be transferred.

[0043] The distributor tube (**19**) is supplied by a pump (**17**) via a throttle valve (**18**). The pressure-amount control is effected in a throttle-bypass system using the throttle valve (**18**) in connection with the adjustable pressure relief valve (**22**). For the purpose of maintenance the oil of the piling device can be drained via an outlet valve (**23**) and the return duct (**24**) into the reservoir (**5**). To prevent any contingent oil evaporation of very high fluidity oils, the inlet and outlet slots of the oiling device may be provided with adjustable felt strips (**25** and **26**). The felt strips are optionally also strippers for contingent contaminations on the punching strips (**1**).

[0044] FIG. **3** shows a diagrammatic view of the main functional group of a preferred example comprising a top roller (**30**) and a bottom roller (**31**) for application rollers which form a gap, and the strip (**1**) to be oiled is drawn through the gap (variation B). An oil dosing tube (**32**) is assigned to the top roller (**30**) as an apparatus that coats the lateral surface of the application roller with oil. The bottom roller (**31**) in contrast is immersed in the oil bath (**33**). Both the rollers are each assigned a coating knife (**34**) and (**35**), respectively. With a support (not illustrated), the rollers (**30**) and (**31**) connect to the coating knives (**34**) and (**35**). The distance of the coating knives (**34**) and (**35**) to the lateral surface of the rollers (**30**) and (**31**) is adjustable by the control elements (**36**) and (**37**), which are preferably micrometer gauges or fine thread screws. Adjusting the gap heights S1 and S2 to different values, is feasible without difficulty. The gap S2 between the coating knife (**34**) and the lateral surface of the bottom roller (**31**), as illustrated, is larger than the gap S1 between the coating knife (**35**) and the lateral surface of the top roller (**30**) in the illustration. Accordingly, there is more oil applied to the bottom surface of the strip (**1**) than to the upper surface thereof.

[0045] The functional group illustrated in FIG. **3** can be installed by different ways and means. In FIG. **4** the functional group is installed in a frame (**41**). Within the frame, the vertical advancement of the rollers (**42** and **43**) to the punching strip is by displaceable sliding blocks (not illustrated). Here as well, the top roller (**42**) and the bottom roller (**43**) are each assigned a coating knife (**44**) and (**45**), respectively, and the oil dosing tube (**46**) and the oil bath (**47**). The oil is fed steadily to the oil dosing tube (**46**), preferably by a membrane pump. The supplied quantity can be regulated by a throttle valve, for example. The level of the oil bath (**47**) can be matched flexibly to the position of the bottom roller (**43**) by the pivotably supported drain tube (**48**). The rollers (**42**) and (**43**) are coupled to one another via an elastic control element, namely a spring (**49**). Excess oil is discharged to an oil reservoir (**50**). The adaptation of the rollers (**42**) and (**43**) to the punching strip (**1**) is effected on the one hand with the aid of the inherent weight of the top roller (**42**) and on the other hand with the aid of the spring (**49**).

[0046] Another example of the device is illustrated in FIG. **5**. Herein, the functional group as illustrated in FIG. **3** is installed in a frame (**51**) including on both sides pivot arms (**52**) and (**53**) which can be locked in place independently. The pivot arm (**52**) allows vertical alignment of the top roller (**54**), the pivot arm (**53**) allows vertical alignment of the bottom roller (**55**). Similar to the previous cases, for oil supply to the rollers (**54**) and (**55**) as oil dosing tube (**56**) and an oil bath (**57**) are provided and the coating knives (**58**) and (**59**) for adjustment of the thickness of the oil film on the rollers (**54**) and (**55**). The top roller and the bottom roller are interconnected via a spring (**60**).

[0047] The devices illustrated in FIGS. **2**, **4** and **5** are each adequate to substitute the device (**4**) in the method as illustrated in FIG. **1**.

1.-**12**. (canceled)

13. A device for oiling strip-shaped material (strip material) comprising at least one application roller which rotates in a running direction of the strip material that applies oil to the strip material, an apparatus that coats a lateral surface of the application roller with oil and a dosing device that adjusts thickness of the oil layer on the application roller.

14. The device according to claim **13**, comprising;

a first application roller which rotates in the running direction of the strip material that oils a bottom surface of the strip material (bottom roller), and

a second application roller which rotates in the running direction of the strip material that oils a top surface of the strip material (top roller),

wherein each of the application rollers is assigned an apparatus that coats the lateral surface of the application roller with oil and a dosing device that adjusts the thickness of the oil layer on the application roller.

15. The device according to claim **14**, wherein the two application rollers are disposed in an offset position relative to another in the running direction of the strip material, or the rollers form a gap, with a height of the gap corresponding approximately to the thickness of the supplied strip material.

16. The device according to claim **14**, wherein at least one of the application rollers is movably supported perpendicular to the running direction of the strip material.

17. The device according to claim **14**, wherein the two application rollers are coupled to one another by an elastic control element.

18. The device according to claim **14**, wherein the two application rollers are disposed on opposite arms of a double-acting lever pivotabiy supported on a pivot.

19. The device according to claim **13**, wherein the at least one application roller has a lateral surface made of synthetic material, metallic material, ceramics, or composite material.

20. The device according to claim **13**, wherein a lateral surface of the at least one application roller has a dimple pattern.

21. The device according to claim **13**, wherein the dosing device is a coating knife.

22. The device according to claim **21**, wherein the coating knife is variably supported relative to the associated application roller so that a gap width between a lateral surface of the application roller and the coating knife is adjustable.

23. The device according to claim **13**, wherein the apparatus that coats the lateral surface of the application roller wets the top roller with oil.

24. A method of oiling strip-shaped material (strip material) comprising:

applying oil to the strip material with at least one application roller which rotates in the running direction of the strip material;

coating the application roller with oil with the aid of an apparatus that coats a lateral surface of the application roller; and

adjusting thickness of the oil layer on the application roller with a dosing device.

25. The device according to claim **15**, wherein at least one of the application rollers is movably supported perpendicular to the running direction of the strip material.

26. The device according to claim **15**, wherein the two application rollers arc coupled to one another by an elastic control element.

27. The device according to claim **16**, wherein the two application rollers are coupled to one another by an elastic control element.

28. The device according to claim **15**, wherein the two application rollers are disposed on opposite arms of a double-acting lever pivotably supported on a pivot.

29. The device according to claim **14**, wherein the at least one application roller has a lateral surface made of synthetic material, metallic material, ceramics, or composite material.

30. The device according to claim **15**, wherein the at least one application roller has a lateral surface made of synthetic material, metallic material, ceramics, or composite material.

31. The device according to claim **16**, wherein the at least one application roller has a lateral surface made of synthetic material, metallic material, ceramics, or composite material.

32. The device according to claim **17**, wherein the at least one application roller has a lateral surface made of synthetic material, metallic material, ceramics, or composite material.

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