(No Model.)

3 Sheets—Sheet 1.

V. B. DAELEN.

CORRUGATING MACHINE.

No. 266,976. Patented Nov. 7, 1882.

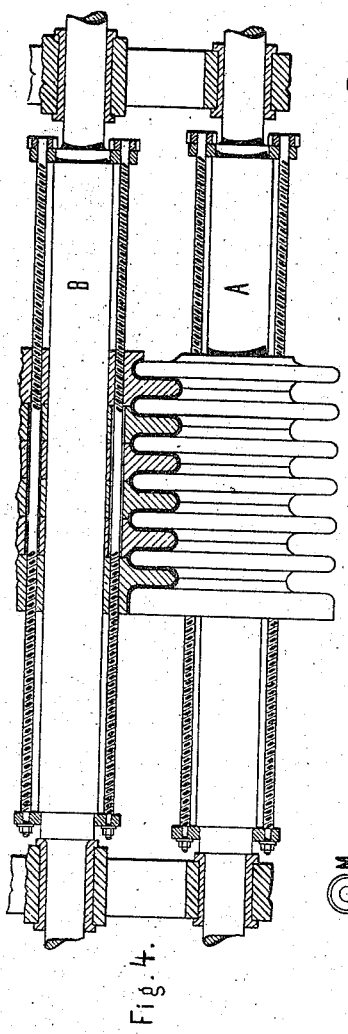

Fig. 4.

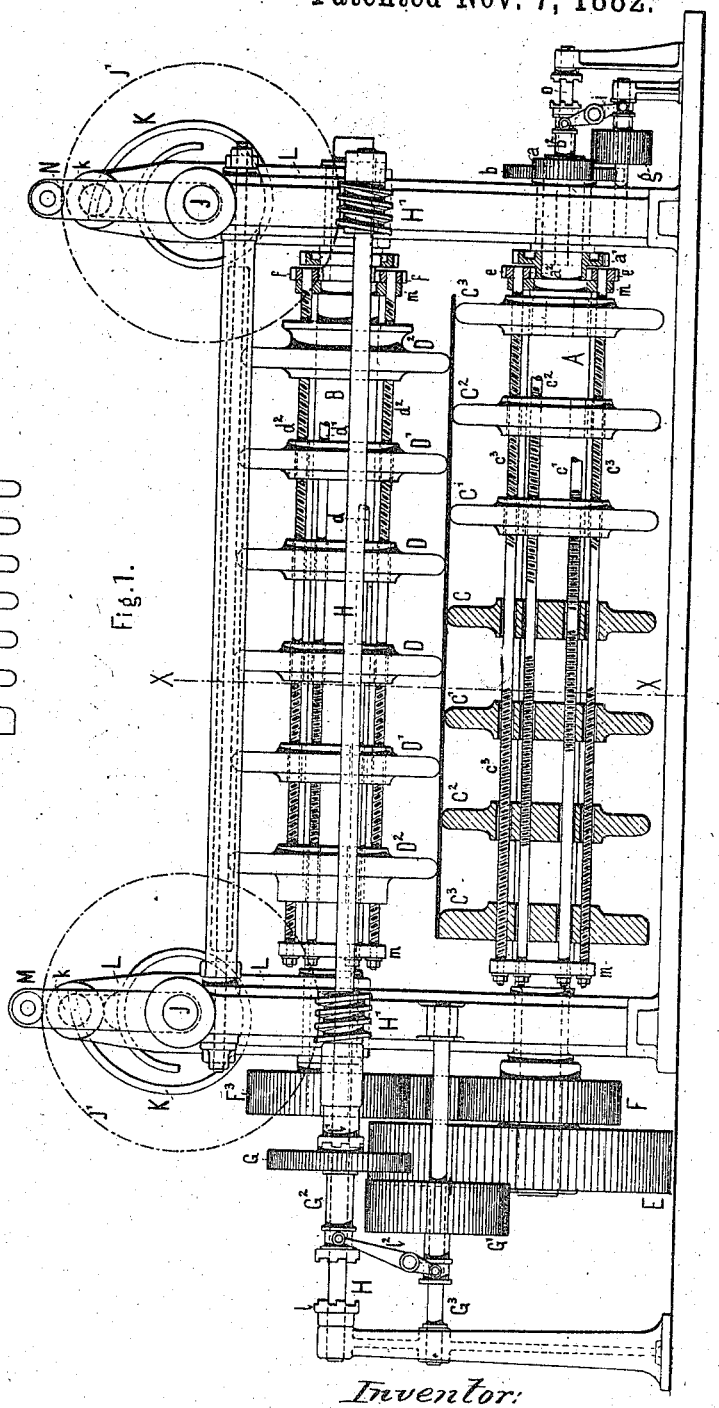

Fig. 1.

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Fig. 6.

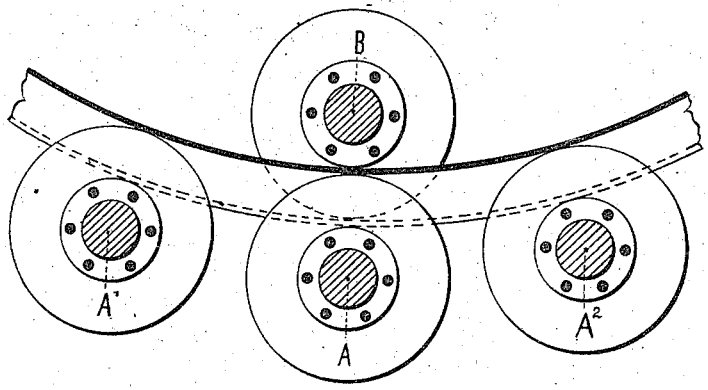
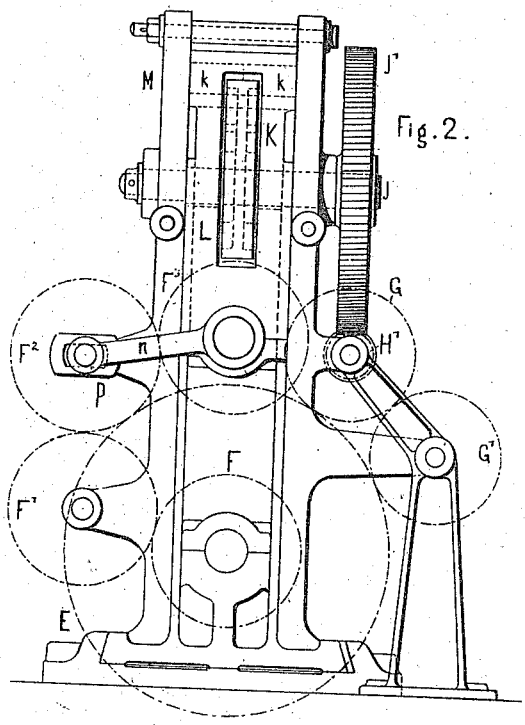


Fig. 2.



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3 Sheets—Sheet 3.

V. B. DAELEN.

CORRUGATING MACHINE.

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Fig. 5.

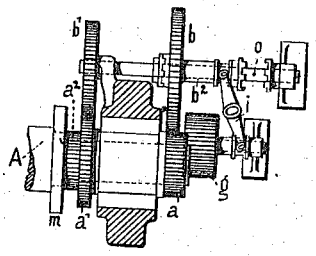
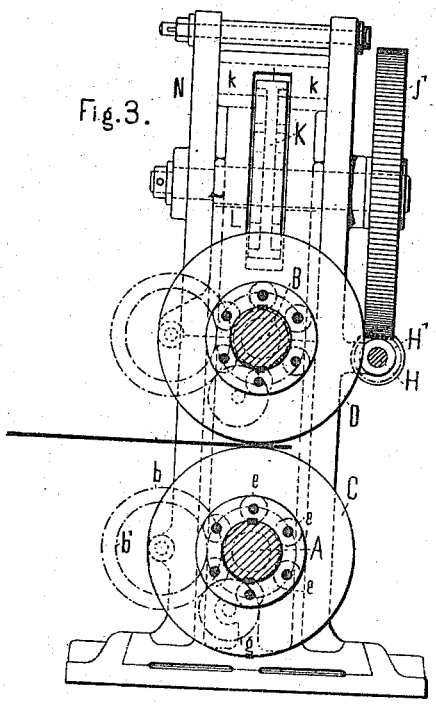


Fig. 3.



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UNITED STATES PATENT OFFICE.

VITAL B. DAELEN, OF BERLIN, GERMANY.

CORRUGATING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 266,976, dated November 7, 1882.

Application filed June 9, 1882. (No model.)

To all whom it may concern:

Be it known that I, VITAL BERNHARD DAELEN, engineer and manufacturer, residing in the city of Berlin, Kingdom of Prussia, Germany, have invented certain new and useful Improvements in Corrugating-Machines, of which the following is a specification.

My invention relates to machines for corrugating plates and tubes by means of a process of rolling, or plates alone by pressing or stamping; and the improvements consist in the construction hereinafter described and claimed.

A rolling-machine comprising my improvements is represented on the annexed three sheets of drawings, Figure 1 being a sectional front elevation; Fig. 2, an end view from the left-hand side; Fig. 3, a vertical section on line *x x*, Fig. 1, looking toward the standard N; Fig. 4, a sectional view of the rollers with the corrugating-rings close together; Fig. 5, a plan of part of the machine, and Fig. 6 a sectional view of an arrangement for corrugating and at the same time bending plates.

The machine shown by Figs. 1 to 5 consists, in the first place, of the roller A, mounted in fixed bearings, and of the roller B, rotating in bearings L L, which are vertically adjustable. The former carries the corrugating-ring C, keyed on the roller, and the like rings C′ C′ C^2 C^2 C^3 C^3, which, while being free to slide thereon, are caused to rotate with the roller by means of feathers. The distance of the movable rings from each other and from the fixed ring C is regulated by the screws c' c' c^2 c^2 c^3 c^3, which are mounted with their ends in the disks *m m*, attached to the roller. The said screws are rotated by a combination of wheels, to be described hereinafter. The screws c' belonging to the rings C′ C′, and of which there are two, one on either side of the roller, work with right-hand and left-hand threads in the corresponding holes of the said rings, whereas they pass with a certain play through holes in the rings C, C^2, and C^3. In a similar manner the screws c^2 are put in relation to the rings C^2, while they pass freely through the rings C, C′, and C^3; but the threads of these screws have double the pitch of the threads of c'. The third pair of screws, c^3, acts on the rings C^3, but with threads of treble the pitch of c'. It is evident herefrom that when all the screws c', c^2, and c^3 are rotated uniformly the distance between any two neighboring rings will be diminished or increased by the same amount.

The corrugating-rings D D D′ D′ D^2 D^2 are arranged on the roller B, and combined with the screws *d d d′ d′* d^2 d^2 in the like manner; but there is no fixed ring, as all the rings except C must be adjusted toward or away from the center of the whole system, which is the vertical central plane of the ring C. The rings D D must, however, be shifted on the roller with but one-half the speed of the rings C′ C′, so that either ring D may always remain opposite to or in the middle of the space between C and C′. Consequently the pitch of the threads of the screws *d d*, belonging to the rings D D, must be equal to but one-half the pitch of the threads on c' c'. For similar reasons, the pitch of the threads on *d′ d′* and d^2 d^2 must respectively be in proportion to the pitch of the threads on c' c', as $\frac{3}{2} : \frac{3}{2} : 1$. These proportions of pitch necessarily require an equal rotative speed for all the screws.

The lower roller, A, is driven by a pinion, (not shown in the drawings,) which gears with the spur-wheel E, keyed on the prolongation of the roller-journal. On the same journal is, moreover, fixed the wheel F, from which rotative motion is transferred by means of the intermediate wheels, F′ and F^2, to the wheel F^3, fixed on the journal of roller B. The wheel F^2 turns on a pivot terminating in a slide-block, which is free to slide horizontally in a slit in the bracket P. Besides, the said pivot is connected by a coupling-bar, *n*, to the journal of roller B. This arrangement causes F^2 to remain in proper gear with F^3, as well as with F′, when the roller B is raised or lowered. The vertical adjustment of the roller B is produced by two cam-disks, K K, keyed on the shafts J J of the worm-wheels J′ J′, which are driven by the worms H′ H′, carried by a common shaft, H. The said cam-disks have on either side a rib, forming a spiral curve, and engaging with a slip cut into the end of either of the two pins or rotative blocks *k k*, mounted in the upper part of the adjustable bearing L. The cam-disks being turned, the ribs of the same will slide in the pins *k*, and by the medium of the latter depress or raise the bearings L. The

said bearings must be provided with an oblong hole for the shaft J to pass through, as otherwise this shaft would prevent them from being moved.

I will now proceed to describe the manner in which the screws c c' c^2 c^3 d d' d^2 and the cam-disks K K are driven, without, however, at present taking into account the reversing of motion of the machine.

On the end of one of the journals of the roller A is fixed the pinion a, which gears with the wheel b on the counter-shaft o, (see Fig. 5,) while the wheel b', keyed on the same shaft, is in gear with the pinion a', placed loose on the roller A. The wheels b and b' being of different diameter, as also the pinions a and a', the said pinion a' will rotate on the roller when the latter turns, and will consequently cause the rotation of the pinion a^2, made in one piece with a'. The pinion a^2 gears with the pinions e, fixed on the ends of the screws c c' c^2 c^3, and thus puts all these screws in uniform rotation. The mechanism serving to drive the screws of the roller B is like the one described. (The same has therefore been omitted in Fig. 1.) It may, however, be observed that the counter-shaft thereof is mounted in arms projecting from the movable bearing L.

The rotation of the shaft H, which drives the cam-disks K by means of the worms H' and the worm-wheels J', is caused by the wheel G, placed on the said shaft and gearing with the wheel E. The spirals, according to which the ribs of the cam-disks K are arranged, must be so formed that for a given angle between two radii the difference of these radii is greatest at the outer end of the curve, while it gradually decreases toward the inner end. The reason herefor is the following: When the speed of rotation of the rollers is uniform the screws of the same will also rotate uniformly. Consequently the corrugating-rings will be shifted together in equal periods of time by the same amount. For a given unit of this shifting motion the amount by which the corrugating-rings D D' D² penetrate into the spaces between the rings C C' C² C³ must at the beginning be greater than toward the end of the operation, because at the outset of the forming of a corrugation the increase of depth of the inflection is greater than toward its completion, provided always that the corrugations are to be produced by bending only. The form of the curve of the cam-disk may be determined by calculation or by drawing.

Considering that the adjustment of the upper roller and of the corrugating-rings must take place while the machine is in operation, the corrugations will at first become tapered—*i. e.*, they will be deeper and narrower at the end of the plate last exposed to the action of the rollers. It is therefore advantageous to let the plate pass alternately forward and backward between the rollers until the corrugations have attained the desired depth. For this purpose the machine requires to be provided with a reversing-gear, which is, however, omitted in the drawings, as it presents no novelty; but though the motion of the rollers be reversed, the adjusting mechanisms must always work forward while a plate is operated upon. It is therefore necessary to reverse these mechanisms in their turn after the whole machine has been reversed, so that in consequence of such double reversion they will continue to work in the same direction. For attaining this object the wheel G, driving the worms H', is fixed on a sleeve, G², the ends whereof form coupling-boxes, which can engage with the coupling-boxes l and l', respectively, fixed on the shaft H. Moreover, a wheel, G', rotating loose on an axle, G³, and gearing with the wheel E, is provided, which may be shifted simultaneously with the sleeve G² and the wheel G, but in the contrary direction, by means of a double-armed forked lever, l^2, as shown by Fig. 1. The parts being in the position represented by drawings, E actuates the shaft H in one direction by means of the wheel G and coupling-box l', while the wheel G', gearing at the edge with E, turns loose on its axle. When the lever l^2 is put into its other position G' is shifted to the right, while G, being shifted to the left, comes out of gear with E and into gear with G', so that G will now rotate in a sense contrary to its previous rotation, provided E continues to turn in the same direction. The left-hand teeth of the sleeve G² having finally been put into engagement with the teeth of the coupling-box l, the shaft H will also rotate again with the wheel G. While this reversal is being carried out the three wheels E, G, and G' will at a certain moment all be in gear with each other. The reversal is therefore possible only while the machine is at rest; but this causes no inconvenience, as the reversal need only be carried out during the stoppage occurring when the plate has arrived with either of its ends near to the rollers, and the direction of motion of the latter has to be changed.

The mechanism for reversing the motion of the screw-spindles is similar to the described arrangement. The wheels a, b, and g correspond respectively to the wheels E, G, and G', the lever i to the lever l^2, and the sleeve b^2 to the sleeve G². In the like mechanism for the roller B (which has not been shown in Fig. 1) the wheel corresponding to g rotates on a pin carried by an arm cast together with the cover of the bearing L. The levers of the different reversing arrangements are by preference so connected with each other that they may be moved simultaneously by a single hand-lever.

As has already been stated, the decrease of distance between the corrugating-rings and between the rollers during the rolling process causes the corrugations to become to a certain degree tapering at first; but when they have attained the desired shape at one end of the plate they are rolled parallel, which is done by passing the plate to and fro several times be-

tween the rollers, while the adjusting mechanisms are stopped from operating, so that the position of the corrugating-rings and of the upper roller remains unaltered. For the purpose of rendering possible such stoppage, the wheels G, G′, and E are arranged in such a manner that G, when being driven by E, will not immediately come into gear with G′ after the sleeve G^2 has been disengaged from l', nor when being driven by G′ will it immediately come into gear with E after G^2 has been disengaged from l. The sleeve may thus be put into two positions, in which it will rotate without causing a rotation of the shaft H. In an analogous manner the transferring-wheels a b g and the teeth of the sleeve b^2, as well as of the coupling-boxes on the shaft o, are brought in relation to each other, (of course in respect to both rollers A and B.) Thus the cam-disks K, as well as the regulating-screws of all the corrugating-rings, may simultaneously be put out of operation while the rollers rotate.

Fig. 6 shows an arrangement for corrugating and at the same time bending plates transversely to the corrugations. The same consists, as in other machines of this kind, of a combination of two adjustable auxiliary rollers, A′ and A^2, with the rollers A and B; but the rollers A′ and A^2 are provided with movable corrugating-rings in the same manner as the roller A.

The devices for adjusting the upper roller, B, and the corrugating-rings may be modified in various ways. In the first place the corrugating-rings may be guided on both sides by forked slide-blocks, which in their turn are guided parallel to the rollers, and through which the regulating-screws pass in a similar manner as has been described in respect to the corrugating-rings shown in the drawings. Moreover, these slide-blocks may be connected together by a system of crossed levers, called "lazy-tongs," the common pivot of each pair of crossed levers being fixed in a slide-block, while the joints at the ends of the levers are in the vertical center line of the space between two blocks. In this case but one screw on either side is required for shifting the slide-blocks, together with the corrugating-rings; also, two-armed levers might be used having arms of different length, each of these levers acting with one end on a slide-block, while their other ends are moved uniformly by a screw. To the arms of these levers such proportions would have to be given as are necessary for imparting to the slide-blocks the requisite motion. In some cases the regulating-screws of the arrangement represented by drawings may be placed inside of the rollers, provided these be made hollow.

Instead of the described cam-disks by which the vertical adjustment of the upper roller is caused, cam-plates having a rectilinear motion may be employed, which act analogously to the former on the bearings L L, and the operating-faces of which are inclined at a greater angle upon the part which first comes into action than upon the part which acts last. These cam-plates are, indeed, the equivalents of the cam-disks, inasmuch as they cause the same kind of vertical motion as the latter, with the sole difference that their own motion is horizontal and rectilinear, whereas the cam-disks have a rotary motion. Another arrangement for the adjustment of the upper roller consists in the use of screws which are driven with decreasing speed by means of a combination of wheels of special shape.

The rolling-machine represented by drawings may also be used for pressing corrugations into tubes. For this purpose the front standard, N, together with its appurtenances, must be so arranged that the front end of the roller B may be made free in order to allow the tube to be brought on the roller and to be taken off again; and, besides, the roller must, during this manipulation, be prevented from dropping at its forward end by means of a suitable support which does not interfere with the tube to be corrugated. When the corrugations are to be formed by presses, straight or curved dies with projecting ribs or ledges are required, instead of the rollers and the rings of the machine hereinbefore described. For the rest the arrangement does not substantially differ from the foregoing. The said ribs or ledges are made movable on the body of the dies in a similar manner as the corrugating-rings on the rollers, and they are provided with screws or other devices, such as described, for causing them to approach each other while the dies are being pressed together. Besides, the mechanisms by which the ledges on one hand and the dies on the other hand are moved are again so constructed and combined that the corrugating operation is carried out solely by bending the plate, all in a like manner as has hereinbefore been specified in respect to the rolling-machine.

I claim as my invention—

1. In machines for the manufacture of corrugated plates and tubes, the combination, with a base consisting in a roller or a die, of movable corrugating rings or ledges and the screws c c' c^2, &c., and d d' d^2, &c., by which the said rings or ledges are shifted together during the formation of the corrugations transversely to the latter, substantially as and for the purpose described.

2. The combination, with the movable corrugating rings or ledges C C′ C^2 C^3 D D′ D^2, &c., of the rotating screws c c' c^2 c^3 d d' d^2, &c., having different pitch, and operating on the said rings or ledges, substantially as specified.

3. The combination, with the roller B, provided with the movable rings D D′ D^2, &c., and the screws d d' d^2, &c., of the cam-disks K K, or the described equivalent cam-plates, acting on the bearings L L of the roller B, as hereinbefore set forth.

4. The combination, with the driving-gears, cam-disks K, or equivalent cam-plates, and

the adjusting-screws *c c'*, &c., and *d d'*, &c., of reversing mechanisms consisting of a countershaft with two fixed coupling-boxes and a loose coupling-sleeve arranged to engage with either of these boxes, and carrying fixed thereon a toothed wheel, which, according to the position of the coupling-sleeve, gears with one or the other of two toothed wheels rotating in different directions, substantially as and for the purpose described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

VITAL BERNHARD DAELEN.

Witnesses:
AUGUST BACHMEYER,
B. ROI.