The invention relates to a method for extending an automobile manufacturing plant in order to increase the vehicle production rate and in order to obtain a new plant from a plant some years older, wherein welding (2) and assembly (4) workshops located on an enclosed ground (10) are extended at the ground level towards the periphery of said enclosed ground from their respective former locations which are also preserved.
Fig. 1
METHOD FOR EXTENDING AN AUTOMOBILE MANUFACTURING PLANT AND RELATED PLANTS

[0001] The invention relates to the field of methods for expanding a motor vehicle manufacturing plant, as well as the field of motor vehicle manufacturing plants that exist pre-expansion, as they are obtained post-expansion. The motor vehicles in question are preferably passenger cars or light utility vehicles. The production rate figures given herein are for passenger vehicles or light utility vehicles, but not trucks, for example.

[0002] In a motor vehicle manufacturing plant, one attempts to reach the best possible compromise between various constraints. The quality of the vehicles manufactured and the ergonomics of manufacturing plant operations are to be maximized as much as possible, relative to an industrial investment, which one tries to minimize as much as possible. This manufacturing plant must do its best to accommodate the diversity of vehicles to be manufactured, if not in all vehicle segments, then at least within one vehicle segment. Over time, the variation in needed vehicle production volume can be significant, and this provides an incentive to try and make the plant upgradable, while pushing down the cost of transitioning from one upgrade stage to another. This is especially true in countries with emerging markets, where the desired vehicle production rate may be initially low, and then increase to end up becoming significant, reaching the level that this production might have in countries with developed markets.

A plant that can be expanded relatively easily over time and at a reasonable cost is an upgradable plant. A plant is upgradable as opposed to conventional plants, where increases in the production rate either result in plants that are not optimized in terms of output or necessitate practically leveling the existing plant and building over again from scratch in order to be able to optimize output. Conventional plants have been built for a given production rate or for a given range of production rates, and were not designed from the outset to shift to higher production rates with output still optimized.

[0003] According to a prior art for an upgradable plant, described for example in French patent application FR 2638196 and American application US 20020129566, a way is known to build a plant in which the various workshops are made up of modular elements. Having these modular elements makes the plant highly upgradable, and this is the case somewhat regardless of the initial arrangement. However, no matter what the upgrade stage, whether at the outset or in process, these modular elements do not allow for much flexibility in the initial arrangement of the plant, nor for optimized output. That is, a significant constraint hinders this type of upgradable plant, i.e., the necessity of reducing the various production lines, and the various logistical zones, to a combination of one or more modular elements with an identical, or at least similar, fixed structure.

[0004] The invention proposes a radically different approach. Upgradability will be relatively easy to provide, not because the plant would be made of identical or similar basic building blocks arranged in some initial order to which other basic building blocks are easily added, but rather because the initial arrangement of the plant, i.e., the initial configuration of its various parts, is designed in a particular way that allows for relatively easy upgradability, even if all or part of the initial plant is in the form of masonry structures. The invention is still usable with a plant made of prefabricated modular elements, but clearly has less relevance. In each upgrade stage, the compromise that is made between increasing the production rate on the one hand and minimizing investment and resulting disturbances within the plant on the other incorporates the compromises pertaining to the other planned upgrade stages. By preference, we aim for quick adaptability while keeping investments virtually linear in the transition from one upgrade stage to another.

[0005] Preferably, said upgradability should be attained on a constant landholding area. The landholdings acquired at the outset must be adequate for all projected production rates for the future, at the lowest possible initial investment. In other words, it is a matter of determining the smallest land area that must be purchased at the outset, knowing that there will be little or no additional land when the production rate is increased. It is also a matter of determining what initial configuration of the plant will cause the least possible disruption when the production rate increases, and not be too expensive initially, although this initial configuration may cost more than one that would be optimal for a low-production plant, but would be practically impossible to upgrade under reasonable conditions.

[0006] The invention proposes a method for expanding a motor vehicle manufacturing plant so as to increase the vehicle production rate. This expansion method will be applied with particular efficiency when the plant to which this method is applied has a suitable configuration. Consequently, the invention also proposes the corresponding plants installed before expansion. The plants obtained after expansion are also within the scope of the invention.

[0007] According to the invention, a method is provided for expanding a motor vehicle manufacturing plant for increasing the vehicle production rate, so as to obtain a new plant from a plant some years older, characterized in that: body welding and assembly shops located on an enclosed site are expanded on the ground level toward the periphery of said enclosed site from their previous respective locations, which are retained. Said workshops are preferably of masonry construction.

[0008] According to the invention, provision is also made for a motor vehicle manufacturing plant comprising: an enclosed site; a body welding shop located on the enclosed site; a paint shop located on the enclosed site; an assembly shop located on the enclosed site; built areas for support functions respectively associated with said workshops and located on the enclosed site; characterized in that: said built areas are grouped together in the central part of the enclosed site; the workshops extend from said built areas toward the periphery of the enclosed site; the body welding shop is located facing the paint shop, disregarding said built areas; the assembly shop is located facing both the body welding shop and the paint shop, disregarding said built areas.

[0009] According to the invention, provision is also made for a motor vehicle manufacturing plant comprising: an enclosed site; a body welding shop located on the enclosed site; a paint shop located on the enclosed site; an assembly shop located on the enclosed site; built areas for support functions respectively associated with said workshops and located on the enclosed site; characterized in that: said built areas are grouped together in the central part of the enclosed site; the workshops extend from said built areas toward the periphery of the enclosed site; the workshops are arranged in a T configuration, so that firstly, the body welding and paint shops are each located between the horizontal line of the T
and the vertical line of the T, and secondly, the assembly shop is located on the opposite side of the horizontal line of the T from the vertical line of the T. The assembly shop is located on the opposite side of each horizontal half-line of the T from the vertical line of the T, with said vertical line of the T delimiting the two horizontal half-lines of the T.

According to the invention, provision is also made for a motor vehicle manufacturing plant comprising: an enclosed site; a body welding shop and an associated built area for support functions located on the enclosed site; a paint shop and an associated built area for support functions located on the enclosed site; an assembly shop and an associated built area for support functions located on the enclosed site; characterized in that: said built areas are grouped together in the central part of the enclosed site; the workshops extend from their respective built areas toward the periphery of the enclosed site; a first wall of the body welding shop is parallel to or coincident with a first wall of the paint shop; a second wall of the body welding shop, orthogonal to the first wall of the body welding shop, is parallel to or coincident with a wall of the assembly shop; a second wall of the paint shop, orthogonal to the first wall of the paint shop, is parallel to or coincident with said wall of the assembly shop.

In the manufacturing plants to which the expansion method according to the invention can be applied, the body welding, paint and assembly shops are preferably of masonry construction, and not assemblages of prefabricated units.

The invention will now be described in greater detail using the annexed figures, which are given as illustrative and non-limiting examples, in which:

FIG. 1 schematically shows an example of a low-output motor vehicle manufacturing plant according to the invention;

FIG. 2 schematically shows an example of a medium-output motor vehicle manufacturing plant according to the invention;

FIG. 3 schematically shows an example of a high-output motor vehicle manufacturing plant according to the invention.

FIG. 1 schematically shows an example of a low-output motor vehicle manufacturing plant according to the invention. By way of indication, a low output means that fewer than 20 vehicles are manufactured per hour.

The plant is built on a site 10. This site 10 is enclosed; it is surrounded by a fence 11. This does not mean that the site is completely surrounded by a fence that makes it totally inaccessible, as a military site would be. At a minimum, the fence comprises temporary or permanent openings that allow the various entering and exiting traffic to flow. This means that the site is clearly and visibly delimited from its surroundings, and this delimitation is preferably in the form of a fence—solid or wire mesh—around the site, comprising openings, which can be either permanent, like gaps in the enclosure, or temporary, like gates, for example.

Built areas 1 are found in the central part of the site 10, in the form of multiple separate buildings or in the form of a common building, for housing support functions. These built areas 1 for support functions relate to certain common facilities, such as administrative offices that provide administrative support for the workshops around them.

The built areas 1 are surrounded by various workshops extending from the central part of the site 10, where the built areas 1 are grouped together, toward the periphery of the site 10 in the direction of the fence 11. These workshops include at least a body welding shop 2, a paint shop 3, and an assembly shop 4. In the body welding shop 2 the vehicle bodies are assembled, typically from pre-stamped sheet metal panels. The welding shop proper, which includes the production line or lines, corresponds to zone 21, whereas the logistical support associated with body welding corresponds to zone 22. In the paint shop 3, the vehicle bodies are painted. In the assembly shop 4, the painted vehicle bodies are outfitted to become complete, drivable vehicles. The assembly shop proper, which includes the production line or lines, corresponds to zone 41, whereas the logistical support associated with assembly corresponds to zone 42. Logistical support includes in particular the parts and subassemblies that will be fed into the production line.

A zone 40 corresponds to the rolls-test area, i.e., the last stage of production following assembly, comprising the steps of testing and adjusting the newly manufactured vehicles.

All of the workshops are preferably of masonry construction and advantageously comprise only one level, generally the ground floor, where all work processes on the vehicle and all value-added assembly tasks, such as headlight installation, are done, i.e., generally on the ground level. However, workshops can comprise one or more additional floors where some or preferably all transfer and transport processes are carried out on vehicles in production, either from one line to another in the same workshop or from one workshop to another, with these processes being performed at a higher level, in particular so as not to obstruct the assembly line or the traffic flows in the logistical zones inside the workshops. The workshops comprise walls. These walls are either exterior walls that set the boundary between the workshop and the outside, or interior walls setting the boundary between the workshop and another building, but they are not optional partitions inside the workshop separating the various parts of the workshop from one another. Some walls have been identified in particular. For the body welding shop 2, the walls are WW1 and WW2. For the paint shop 3, the walls are WP1 and WP2. For the assembly shop 4, the wall is WA.

In order to clarify the configuration of the various workshops in relation to one another, a virtual T has been drawn in the figures; however it does not actually correspond to anything concrete. This T has a horizontal line H and a vertical line V. In the figure, the T has been rotated one quarter turn to the right. But arranging the T otherwise on the site will also work, provided that the relative configuration of the workshops is kept, in an identical or symmetrical form. In other words, relative to the configuration shown in FIGS. 1 to 3, configurations obtained by rotation or by axial symmetry are also workable.

Other elements are also located on the site 10, such as a vehicle touch-up lot 5, a new vehicle lot 6, a road shipment facility 7, a rail shipment facility 8 including a section of railway on the site 10, and a supply chain site 9. Alternatively, the supply chain site 9 can be located outside the site 10 on the other side of the fence 11, and, if not next to the site 10, it is at least in the immediate vicinity thereof. The vehicle touch-up lot 5 is the place for storing manufactured vehicles with certain defects that need to be corrected before being shipped to the sales lot. The new vehicle lot 6 is the place for storing manufactured vehicles that are ready to be shipped to the sales lot. These vehicles that are ready to be shipped to the sales lot are waiting to be shipped to the sales points either by highway transport from the road shipment facility 7 or by rail...
transport from the rail shipment facility. A test track, on which the manufactured vehicles are driven before being stored on the new vehicle lot, preferably remains unchanged throughout all the plant upgrades. This track is preferably located either on the other side of the rail shipment facility, in which case a bridge or a tunnel is provided for access to it (option 1), or next to the assembly shop (option 2).

[0024] The arrow P1 shows the vehicle production flow, which in FIGS. 1 and 2 goes from the body welding shop 2, through the paint shop 3, to the assembly shop 4. This arrow is a dashed line. The arrow F1 shows the flow of raw materials, elements and vehicle subassemblies originating from the manufacturer itself and supplying the plant. The arrow F2 shows the flow of raw materials, elements and vehicle subassemblies originating from suppliers and supplying the plant, preferably synchronously with vehicle production. The arrow F3 shows the flow of new vehicles shipped to the sales lot by road. The arrow F4 shows the flow of new vehicles shipped to the sales lot by train.

[0025] In a preferred example with figures, the production rate is 14 vehicles per hour and the total ground area covered is about 75,000 square meters, plus or minus 10%. The area covered encompasses the workshop buildings, the support function buildings, and the other buildings, but it excludes the lots, the test track and the road and rail shipping areas, for example.

[0026] FIG. 2 schematically shows an example of a medium-output motor vehicle manufacturing plant according to the invention. By way of indication, a medium output means that between 20 and 40 vehicles are manufactured per hour.

[0027] The body welding shop 2 and the assembly shop 4 have been extended toward the periphery of the site 10, but not toward the central part of the site 10. The paint shop 3 has been extended toward the periphery of the site 10 and toward the central part of the site 10. The paint shop 3 has been extended proportionally less than the body 2 and assembly 4 shops. That is, for the paint shop 3, firstly, the increased production rate is achieved more by accelerating the production line than by extending the production line geographically, and secondly, the logistical zones are much smaller than for the body welding 2 and assembly 4 shops. The body areas 1 have been slightly extended toward the periphery of the site 10. The vehicle touch-up lot 5 and the new vehicle lot 6 have been extended. The supply chain site 9 has not changed. For the body welding shop 2, as well as for the assembly shop 4, the workshop proper as well as the associated logistical zone have been extended toward the periphery of the site 10.

[0028] In the same preferred example with figures, the production rate has become 28 vehicles per hour and the total ground area covered is now about 130,000 square meters, plus or minus 10%.

[0029] FIG. 3 schematically shows an example of a high-output motor vehicle manufacturing plant according to the invention. By way of indication, a high output means that more than 40 vehicles are manufactured per hour.

[0030] The arrow P1' represents the vehicle production flow, which starts at the stamping shop 12, goes next to the body welding shop 2, then to the paint shop 3, and lastly to the assembly shop 4. This arrow is a dashed line.

[0031] The body welding shop 2, the paint shop 3, and the assembly shop 4 have been extended toward the periphery of the site 10, but not toward the central part of the site 10. The paint shop 3 has been extended proportionally less than the body 2 and assembly 4 shops. That is, for the paint shop 3, firstly, the increased production rate is achieved more by accelerating the production line than by extending the production line geographically, and secondly, the logistical zones are much smaller than for the body welding 2 and assembly 4 shops. The built areas 1 have been slightly extended toward the periphery of the site 10. The new vehicle lot 6 has continued to expand, while the vehicle touch-up lot 6 has not changed. The supply chain site 9 has not changed. For the body welding shop 2, as well as for the assembly shop 4, the workshop proper as well as the associated logistical zone have been extended toward the periphery of the site 10.

[0032] In the same preferred example with figures, the production rate has become 55 vehicles per hour and the total ground area covered is now about 240,000 square meters, plus or minus 10%.

[0033] More generally speaking, and aside from the precise example shown and described in FIGS. 1 to 3, or in combination with said example, various preferred options can be present by themselves or in combination with one another.

[0034] Built areas 1 are respectively associated with the various workshops. Each shop—body welding 2, paint 3, and assembly 4—preferably has an associated built area. Part or all of the various built areas 1 can be grouped together in a common building shared by one or more workshops. The built areas 1 are grouped together in the central part of the enclosed site 10. The central part is comparatively toward the middle and thus far from the fence 11, whereas the periphery of the site 10 is more in the vicinity of the fence 11, but inside the fence 11.

[0035] In a first variant embodiment of the initial or prior plant, to be upgraded, the body welding shop 2 is located facing the paint shop 3, disregarding said built areas 1. If we pretend to remove the built areas 1, the body welding shop 2 and the paint shop 3 end up directly beside one another, and one side of the body shop 2 faces one side of the paint shop 3. Likewise, the assembly shop 4 is located facing both the body welding shop 2 and the paint shop 3, disregarding said built areas.

[0036] In a second variant embodiment of the initial or prior plant, to be upgraded, which is more efficient than the first variant, the workshops are arranged in a T configuration, so that firstly, the body welding 2 and paint 3 shops are each located between the horizontal line of the T and the vertical line of the T, and secondly, the assembly shop 4 is located on the opposite side of the horizontal line of the T from the vertical line of the T. More precisely, the body welding shop 2 is located in one of the two angular areas bounded by the line H and the line V, just as the paint shop 3 is located in the other one of these two angular areas. The line H separates the site 10 into two half-planes, one containing the line V and the other containing the assembly shop 4.

[0037] In a third variant embodiment of the initial or prior plant, to be upgraded, which is more efficient than the first variant, the walls of the various workshops have a particular configuration. A first wall WW1 of the body welding shop 2 is parallel to or coincident with a first wall WP1 of the paint shop 3. A second wall WW2 of the body welding shop 2, orthogonal to the first wall WW1 of the body welding shop 2, is parallel to or coincident with a wall WA of the assembly shop 4. A second wall WP2 of the paint shop 3, orthogonal to the first wall WP1 of the paint shop 3, is parallel to or coincident with said wall WA of the assembly shop 3.
The commonality between these three variants, which offer different degrees of efficiency, is in proposing an initial or prior configuration that allows for significant upgradability with a limited level of disruption and a reasonable initial investment, in that the size of the enclosed site needed for the different proposed plant sizes—preferably three—is not excessive relative to the size of the plant that has the low vehicle production rate. A limited level of disruption means trying to interfere as little as possible—or not too much, at any rate—with anything relating to general facilities such as the energy supply, waste treatment and maintenance, and with anything relating to administrative and social facilities, such as computer facilities, offices, first aid, and the cafeteria. Limiting the level of disruption also depends on having a pattern of minimally impacting and disturbing the flow of people and vehicle traffic, in the plant in general, and in the workshops in particular. Although it has new features after being expanded, the upgraded plant, i.e., one that has been upgraded from an initial or prior plant, preserves the features of said initial or prior plant from which it was created. An initial plant is a prior plant that has the following characteristic: either no other motor vehicle manufacturing plant has existed on this enclosed site or the existing structures of a former plant were torn down before the new plant was built on a site emptied of its buildings.

Preferably, a vehicle touch-up lot 5 and a new vehicle lot 6 are located on a same side of the enclosed site 10 in relation to the complex composed of the built areas 1 and the workshops 2 to 4. A supply chain site 9 is located on another side of the enclosed site 10 than the vehicle touch-up lot 5 and the new vehicle lot 6 in relation to the complex composed of the built areas 1 and the workshops 2 to 4. This other side is advantageously the opposite side, as in the figures, or it can be an adjacent side. This way of balancing the distribution of the various peripheral parts of the plant makes it possible for each of them to expand over time without being crowded by the neighboring parts and without crowding the neighboring parts.

Preferably, a roll-off test area 40 located on the enclosed site 10 and intended for testing the vehicles coming out of the assembly shop 4 is a) integrated into the assembly shop 4 and b) located on the same side as the vehicle touch-up lot 5 and the new vehicle lot 6. The roll-off test area 40 can also be contiguous with the assembly shop 4 and separated from said assembly shop 4 by a wall instead of being integrated into the assembly shop 4. This way, once the vehicles are manufactured, they go directly either to the vehicle touch-up lot 5 if they have defects, or to the new vehicle lot 6 if they have no defects to correct or after having first gone through the vehicle touch-up lot 5 if they had one or more defects to correct.

A test track 13 is preferably located on the enclosed site 10 between a) the vehicle touch-up lot 5 and the new vehicle lot 6 and b) the complex composed of the built areas 1 and the workshops 2 to 4. This arrangement of the test track 13 will allow it to remain unchanged without getting in the way of the expansion of the other parts of the plant.

There is preferably a railway track going into the enclosed site 10 to the rail shipment facility 8, running along the edge of the enclosed site on the opposite side of the vehicle touch-up lot 5 and the new vehicle lot 6 from the complex composed of the built areas 1 and the workshops 2 to 4. The vehicles stored in the new vehicle lot 6 can thus be sent directly to the sales lot as easily by train as they can be by road.

Preferably, for an initial plant, the plant was directly built on the virgin enclosed site 10 and the vehicle production rate is less than 20 vehicles per hour. This is the case in which a low-output plant is built directly on a site with no buildings, or on which the buildings were torn down beforehand. Whether the fence 11 was installed before or after the construction of the plant is of no importance.

Preferably, for an initial plant, the plant was directly built on the virgin enclosed site 10 and the vehicle production rate is between 20 and 40 vehicles per hour. This is the case in which a medium-output plant is built directly on a site with no buildings, or on which the buildings were torn down beforehand. Whether the fence 11 was installed before or after the construction of the plant is of no importance.

When the upgradable plant is expanded, the result of the upgrade will be a bigger plant that will offer some advantageous features, either for its own operation or for the possibilities that it will enable later in the next upgrade phase.

Preferably, the plant has been expanded from a prior plant built some years earlier and whose vehicle production rate was lower. It is actually another plant originating from the expansion of an initial or prior plant that was in production. Thus, these are not two construction phases for the same plant, where there was no production going on between the two phases, or where there were only machine and production line tests or shake-downs between the two phases. The body welding 2, paint 3, and assembly 4 shops have been expanded on the ground level from their previous respective locations, which have been retained. Expanding a workshop on the ground level means increasing its area on the ground level and not increasing its area just by adding or filling in a second floor, for example. When the location of a workshop on the ground level is retained, the new workshop, apart from being bigger than the old workshop, substantially covers the location of the old workshop; in other words, the workshop has been expanded and not replaced by a bigger workshop located elsewhere. Retaining previous locations makes it possible to keep at least part of the interior facilities of the workshop, as well as part of the interior and/or exterior masonry of the workshop, if applicable.

Preferably, the plant has been expanded from a prior plant built some years earlier and whose vehicle production rate was lower. The body welding 2 and assembly 4 shops have been expanded on the ground level toward the periphery of the enclosed site 10. The body welding 2 and assembly 4 shops have not been expanded on the ground level toward the central part of the enclosed site 10. Due to their internal structure, the body welding 2 and assembly 4 shops are expanded exclusively toward the periphery of the site 10.

Preferably, the plant has been expanded from a prior plant built some years earlier and whose vehicle production rate was lower. The paint shop 3 has been expanded on the ground level toward the periphery of the enclosed site.

The test track 13 has preferably not changed. It did not need to be expanded or moved when the production rate changed. The track 13 entrance is preferably located near the roll-off test area 40 exit and the vehicle touch-up lot 5, so as to minimize constraints on and interference with the traffic flows inside the plant.

Preferably, the new vehicle lot 6 has been expanded on the ground level from its previous location, which has been retained. The transition zone between the new vehicle lot 6
and the road shipment facility 7 can thus be retained as is. The ground area of the supply chain site 9 has preferably not changed.

[0051] Preferably, the ground area of the enclosed site 10 has not changed. That is, the optimized configuration of the initial plant makes it possible to buy a reasonably sized site at the outset, which will be adequate for all the subsequent planned expansions. Thus, expansion will not be contingent on buying up land later from neighbors who have meanwhile moved in, which often turns out to be a particularly expensive real estate transaction. In the case of a non-optimized initial plant configuration, it may be possible to buy all the land needed for future upgrades at the outset, but since this involves a bigger site, the transaction will be more expensive and may even be out of proportion for the part of the site that will actually be useful for the initial plant.

[0052] A first preferred upgrade consists in transforming an initial or prior plant with a low production rate into a subsequent or upgraded plant with a medium production rate. The plant has been expanded, then, from a prior plant built some years earlier, whose vehicle production rate was less than 20 vehicles per hour. The body welding 2, paint 3, and assembly 4 shops have been expanded on the ground level from their respective previous locations, which have been retained. The vehicle production rate is between 20 and 40 vehicles per hour. The vehicle touch-up lot 5 has preferably been expanded on the ground level from its previous location, which has been retained. The plant preferably does not comprise a stamping shop. That is, at a low production rate, it would not be profitable; it is better to have the stamped sheet metal panels brought in from another plant. The paint shop has preferably been expanded at the ground level toward the central part of the enclosed site.

[0053] A second preferred upgrade consists in transforming an initial or prior plant with a medium production rate into a subsequent or upgraded plant with a high production rate. The plant has been expanded from a prior plant built some years earlier, whose vehicle production rate was less than 20 vehicles per hour. The body welding 2, paint 3, and assembly 4 shops have been expanded on the ground level from their respective previous locations, which have been retained. The vehicle production rate is more than 40 vehicles per hour. The vehicle touch-up lot 5 has preferably been expanded at the ground level from its previous location, which has been retained. The plant preferably does not comprise a stamping shop. That is, at a medium production rate, it would not be profitable; it is better to have the stamped sheet metal panels brought in from another plant. The paint shop has preferably been expanded at the ground level toward the central part of the enclosed site.

[0054] A third preferred upgrade consists in transforming an initial or prior plant with a low production rate directly into a subsequent or upgraded plant with a high production rate. The plant has been expanded from a prior plant built some years earlier, whose vehicle production rate was between 20 and 40 vehicles per hour. The body welding 2, paint 3, and assembly 4 shops have been expanded on the ground level from their respective previous locations, which have been retained. The vehicle production rate is more than 40 vehicles per hour. The ground area of the vehicle touch-up lot 5 has preferably not changed. A stamping shop 12 has preferably been added on the enclosed site near the body welding shop entrance. That is, with a high production rate, this is more profitable than having the stamped sheet metal panels brought from another plant. The paint shop has preferably not been expanded on the ground level toward the central part of the enclosed site.

[0055] The enclosed site 10 preferably has a square shape, which, considering the various directions of expansion for the various parts of the plant, allows it to be fairly compact for a given upgrade level. A rectangular enclosed site 10 would be less efficient, but it would still be workable. Other site shapes, such as a circular one, would be even less advantageous.

[0056] The body welding, paint and assembly shops are preferably of masonry construction. A masonry structure is a structure made of materials joined by a binder. Some nonlimiting examples of such materials are stone, brick, quarry stone, etc. Some nonlimiting examples of binders are mortar, plaster, cement, etc. Building the workshops as “permanent” structures and not as assemblages of prefabricated elements is what gives the initial configuration its whole significance. That is, it is clearly more difficult to move permanent buildings and destroy some parts thereof in order to change the layout of the plant than it is to move or add prefabricated elements that are simply set up and assembled together in a movable manner.

[0057] In order to transform an initial plant into an upgraded plant or an upgraded plant into a further upgraded or final plant, the invention proposes an expansion method. A final plant is a plant that has been upgraded in reasonable conditions, but can no longer be upgraded in reasonable conditions because it has reached the maximum growth that had been planned for it. In this method for expanding a motor vehicle manufacturing plant so as to increase the vehicle production rate, in order to obtain a new plant from a plant some years older, body welding 2 and assembly 4 located on an enclosed site 10 are expanded on the ground level toward the periphery of said enclosed site 10 from their previous respective locations, which are retained. The paint shop 3 located on an enclosed site 10 is preferably expanded on the ground level toward the periphery of said enclosed site 10 from its previous location, which is retained.

[0058] Preferably, the configuration of the workshops in the central part of the enclosed site is not changed. This way, the costs of expansion are less than in a case where the layout in the central part is also changed. The principle consists in starting from an initial configuration for the workshops in which the central part will require few or no changes, with the buildings extending from a relatively fixed central configuration toward an unoccupied periphery.

[0059] In a first variant, the built areas 1 for support functions respectively associated with said workshops 2 to 4 and located on the enclosed site 10 remain grouped together in the central part of the enclosed site 10. The body welding shop 2 remains located facing the paint shop 3, disregarding said built areas 1. The assembly shop 4 remains located both facing the body welding shop 2 and facing the paint shop 3, disregarding said built areas 1.

[0060] In a second variant, the built areas 1 for support functions respectively associated with the workshops 2 to 4 and located on the enclosed site 10 remain grouped together in the central part of the enclosed site 10. The workshops 2 to 4 remain arranged in a T configuration, so that, firstly, the body welding 2 and paint 3 shops each remain located between the horizontal line of the T and the vertical line of the T, and secondly, the assembly shop 4 remains located on the side of the horizontal line of the T opposite the vertical line of the T.
In a third variant, the built areas 1 for support functions respectively associated with the workshops 2 to 4 and located on the enclosed site 10 remain grouped together in the central part of the enclosed site 10. A first wall WW1 of the body welding shop 2 remains parallel to or coincident with a first wall WP1 of the paint shop 3. A second wall WW2 of the body welding shop 2, orthogonal to the first wall WW1 of the body welding shop 2, remains parallel to or coincident with a wall WA of the assembly shop 4. A second wall WP2 of the paint shop 3, orthogonal to the first wall WP1 of the paint shop 3, remains parallel to or coincident with said wall WA of the assembly shop 4.

In a first form of upgrade, the vehicle production rate changes from a rate less than 20 vehicles per hour to a rate between 20 and 40 vehicles per hour. In a second form of upgrade, the vehicle production rate changes from a rate less than 20 vehicles per hour to a rate greater than 40 vehicles per hour. In a third form of upgrade, the vehicle production rate changes from a rate between 20 and 40 vehicles per hour to a rate greater than 40 vehicles per hour. Preferably, in the second and third forms of upgrade, a stamping shop 12 is added on the enclosed site 10 near the body welding shop 2 entrance.

The test track 13 has preferably not changed. The new vehicle lot 6 is preferably expanded on the ground level from its previous location, which is retained. The ground area of the enclosed site has preferably not changed. The workshops are preferably of masonry construction.

1. Motor vehicle manufacturing plant comprising:
   an enclosed site;
   a body welding shop located on the enclosed site;
   an assembly shop located on the enclosed site;
   built areas for support functions respectively associated with said workshops and located on the enclosed site;
   wherein:
   said built areas are grouped together in the central part of the enclosed site;
   the workshops extend from said built areas toward the periphery of the enclosed site;
   the body welding shop is located facing the paint shop, disregarding said built areas;
   the assembly shop is located both facing the body welding shop and facing the paint shop, disregarding said built areas.

2. Motor vehicle manufacturing plant comprising:
   an enclosed site;
   a body welding shop located on the enclosed site;
   a paint shop located on the enclosed site;
   an assembly shop located on the enclosed site;
   built areas for support functions respectively associated with the workshops and located on the enclosed site;
   wherein:
   said built areas are grouped together in the central part of the enclosed site;
   the workshops extend from said built areas toward the periphery of the enclosed site;
   the workshops are arranged in a T configuration, so that firstly, the body welding and paint shops are each located between the horizontal line of the T and the vertical line of the T; and secondly, the assembly shop is located on the opposite side of the horizontal line of the T from the vertical line of the T.

3. Motor vehicle manufacturing plant comprising:
   an enclosed site;
   a body welding shop and an associated built area for support functions located on the enclosed site;
   a paint shop and an associated built area for support functions located on the enclosed site;
   an assembly shop and an associated built area for support functions located on the enclosed site;
   wherein:
   said built areas are grouped together in the central part of the enclosed site;
   the workshops extend from their respective built areas toward the periphery of the enclosed site;
   a first wall of the body welding shop is parallel to or coincident with a first wall of the paint shop;
   a second wall of the body welding shop, orthogonal to the first wall of the body welding shop, is parallel to or coincident with a wall of the assembly shop;
   a second wall of the paint shop, orthogonal to the first wall of the paint shop, is parallel to or coincident with said wall of the assembly shop.

4. Motor vehicle manufacturing plant according to claim 1, wherein a vehicle touch-up lot and a new vehicle lot are located on one side of the enclosed site in relation to the complex composed of the built areas and the workshops, and in that a supply chain site is located on another side of the enclosed site than the vehicle touch-up lot and the new vehicle lot, in relation to the complex composed of the built areas and the workshops.

5. Motor vehicle manufacturing plant according to claim 4, wherein a test track is located on the enclosed site between a) the vehicle touch-up lot and the new vehicle lot and b) the complex composed of the built areas and the workshops.

6. Motor vehicle manufacturing plant according to claim 4, wherein a railway track goes into the enclosed site along the edge of the enclosed site on the opposite side of the vehicle touch-up lot and the new vehicle lot from the complex composed of the built areas and the workshops.

8-9. (canceled)

10. Motor vehicle manufacturing plant according to claim 1, wherein the plant has been expanded from a prior plant built some years earlier and whose vehicle production rate was lower, and the body welding, paint, and assembly shops have been expanded on the ground level from their previous respective locations, which have been retained.

11-15. (canceled)

16. Motor vehicle manufacturing plant according to claim 10, wherein the ground area of the enclosed site has not changed.

17-28. (canceled)

29. Motor vehicle manufacturing plant according to claim 1, wherein the enclosed site has a square shape.

30. Motor vehicle manufacturing plant according to claim 1, wherein the body welding, paint and assembly shops are of masonry construction.

31. Method for expanding a motor vehicle manufacturing plant for increasing the vehicle production rate, so as to obtain a new plant from a plant some years older, comprising:
expanding body welding and assembly shops located on an enclosed site on the ground level toward the periphery of said enclosed site from their previous respective locations, which are retained.

32. Method for expanding a motor vehicle manufacturing plant according to claim 31, wherein the paint shop located on an enclosed site is expanded on the ground level toward the periphery of said enclosed site from its previous location, which is retained.

33. Method for expanding a motor vehicle manufacturing plant according to claim 31, wherein the configuration of the workshops in the central part of the enclosed site is not changed.

34. Method for expanding a motor vehicle manufacturing plant according to claim 31, wherein built areas housing support functions respectively associated with the workshops and located on the enclosed site remain grouped together in the central part of the enclosed site, the body welding shop remains located facing the paint shop, disregarding said built areas, and the assembly shop remains located both facing the body welding shop and facing the paint shop, disregarding said built areas.

35. Method for expanding a motor vehicle manufacturing plant according to claim 31, wherein built areas housing support functions respectively associated with the workshops and located on the enclosed site remain grouped together in the central part of the enclosed site, and the workshops remain arranged in a T configuration, so that, firstly, the body welding and paint shops each remain located between the horizontal line of the T and the vertical line of the T, and secondly, the assembly shop remains located on the opposite side of the horizontal line of the T from the vertical line of the T.

36. Method for expanding a motor vehicle manufacturing plant according to claim 31, wherein built areas housing support functions respectively associated with the workshops and located on the enclosed site remain grouped together in the central part of the enclosed site, a first wall of the body welding shop remains parallel to or coincident with a first wall of the paint shop, a second wall of the body welding shop, orthogonal to the first wall of the body welding shop, remains parallel to or coincident with a wall of the assembly shop, and a second wall of the paint shop, orthogonal to the first wall of the paint shop, remains parallel to or coincident with said wall of the assembly shop.

37-41. (canceled)

42. Method for expanding a motor vehicle manufacturing plant according to claim 31, wherein the ground area of the enclosed site has not changed.

43. (canceled)

44. Method for expanding a motor vehicle manufacturing plant according to claim 31, wherein said workshops are of masonry construction.

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