Campagnolo®

RIM

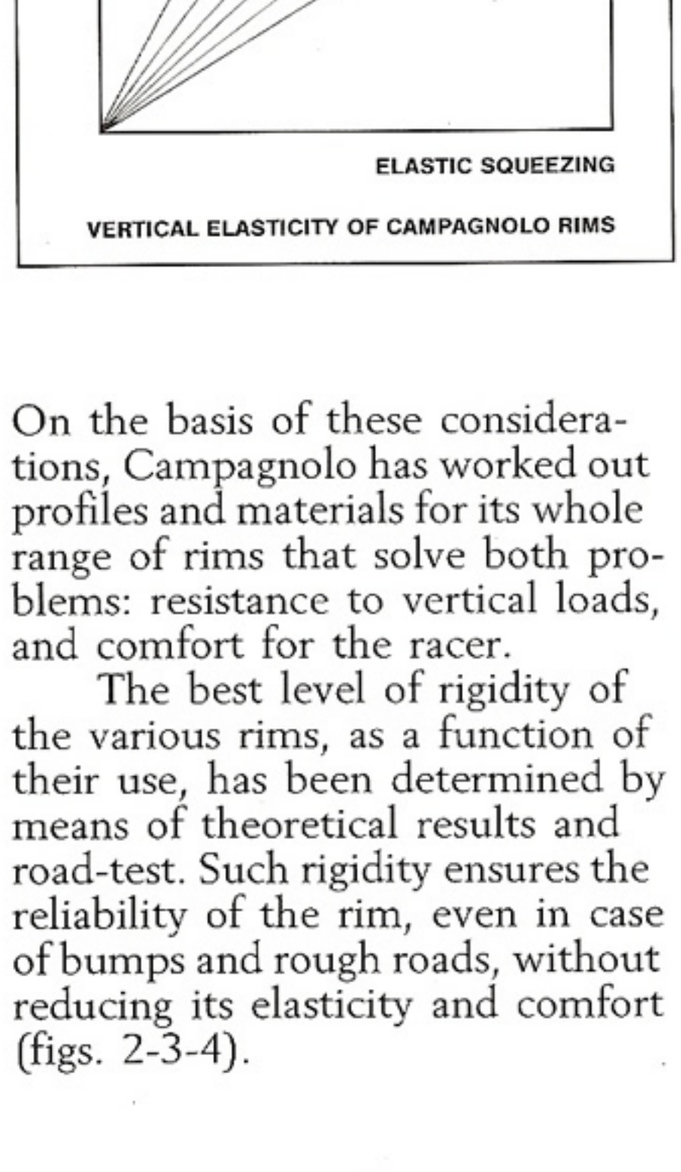
USA

RESISTANCE TO VERTICAL LOAD

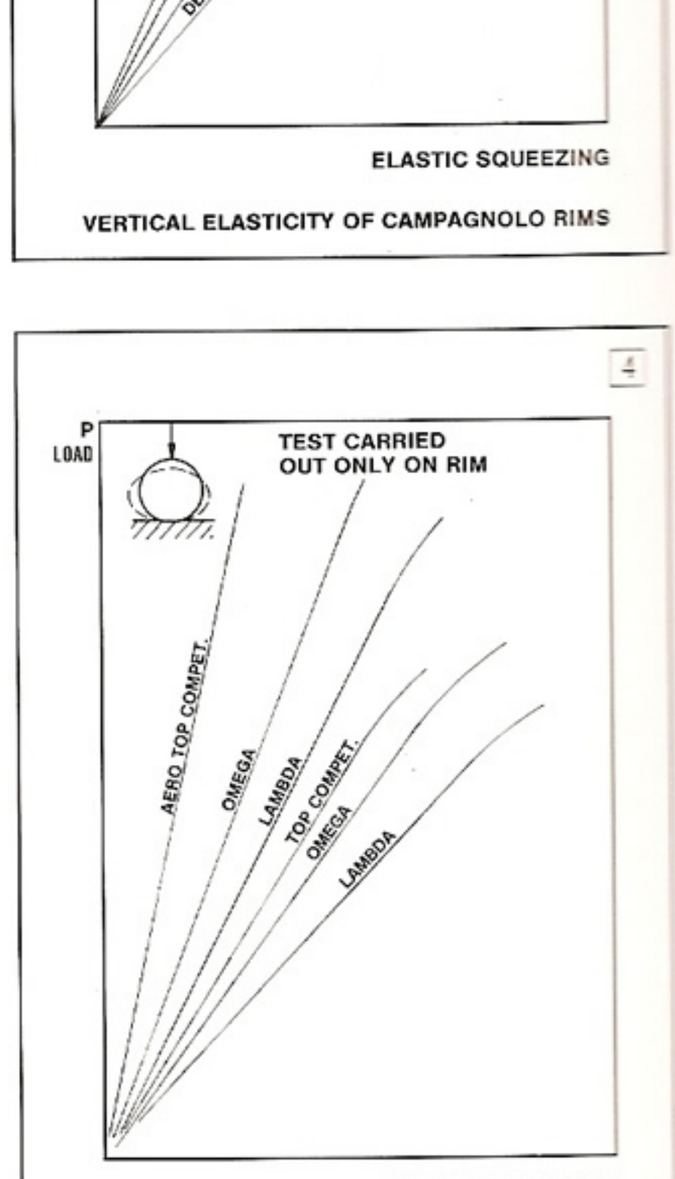
In use, as a result of the racer's weight, the rim undergoes vertical stresses and transversal and torsional stresses due to the forces resulting from pedaling dynamics.

Campagnolo has paid particular attention to determining the resistance of the vertical load since both durability and comfort are directly related to this parameter.

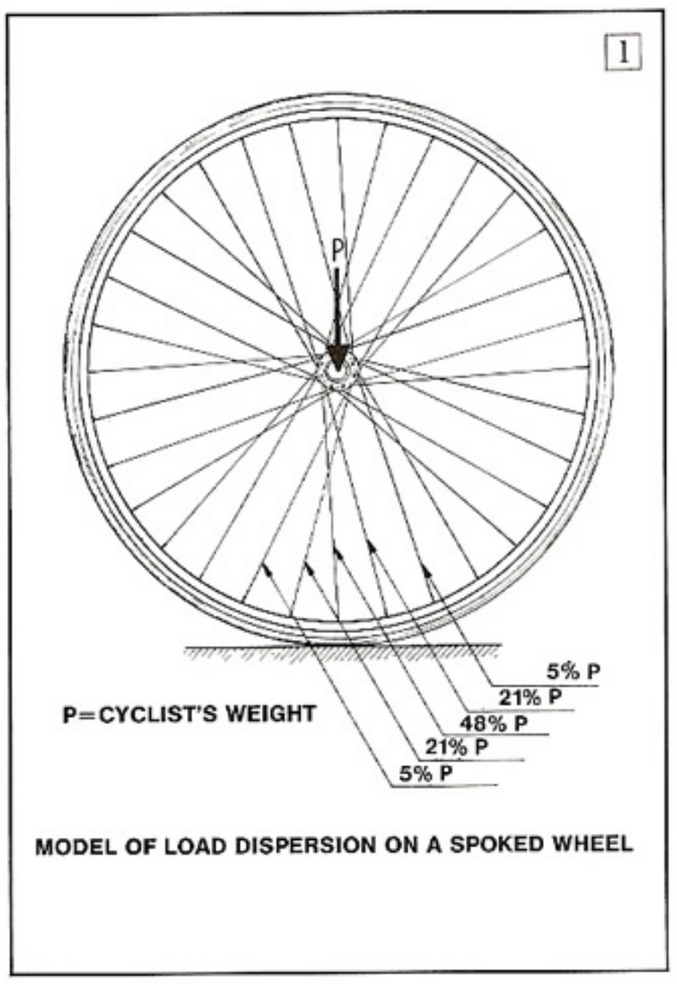
The rim works like a Roman arch which supports itself by dispersing its weight along the circumference. However, in order to support loads which outweigh it without being deformed, the radial tension in a rim with 32 spokes must be greater than 65 Kg; on the back wheel, this tension must be greater than 110 Kg on the right and 60 Kg on the left.



VERTICAL ELASTICITY OF CAMPAGNOLO RIMS



VERTICAL ELASTICITY OF CAMPAGNOLO RIMS



MODEL OF LOAD DISPERSION ON A SPOKED WHEEL

The racer's weight is applied to the hub by studying the behaviour of a spoked wheel fitted with a rim of a known profile, thickness and material, engineers have created a mathematical and physical model. This model enabled the actual stresses on the rim due to the weight to be precisely determined.

The weight applied to the hub is essentially balanced by means of 5 spokes (fig. 1), whose tension is reduced because of the compression. The rest of the system does not undergo important alteration.

On the basis of these considerations, Campagnolo has worked out profiles and materials for its whole range of rims that solve both problems: resistance to vertical loads, and comfort for the racer.

The best level of rigidity of the various rims, as a function of their use, has been determined by means of theoretical results and road-test. Such rigidity ensures the reliability of the rim, even in case of bumps and rough roads, without reducing its elasticity and comfort (figs. 2-3-4).

VERTICAL ELASTICITY OF CAMPAGNOLO RIMS
CROCHET (13C)

RESISTANCE TO TRANSVERSAL AND TORSIONAL STRESSES

Besides the racer's weight the rim undergoes transversal and torsional stresses resulting from the push on pedals.

The ability to absorb these stresses is fundamental for the reliability and efficiency of the rim.

This feature has been optimized by Campagnolo for its whole range of performance rims and in particular for SIGMA, DELTA and OMEGA rims.

In this way the professional or amateur racer does not waste part of the energy he produces while pedaling.

Transversal loads and absorbing capacity are always checked by Campagnolo's quality control laboratory, which utilizes the most modern equipment.

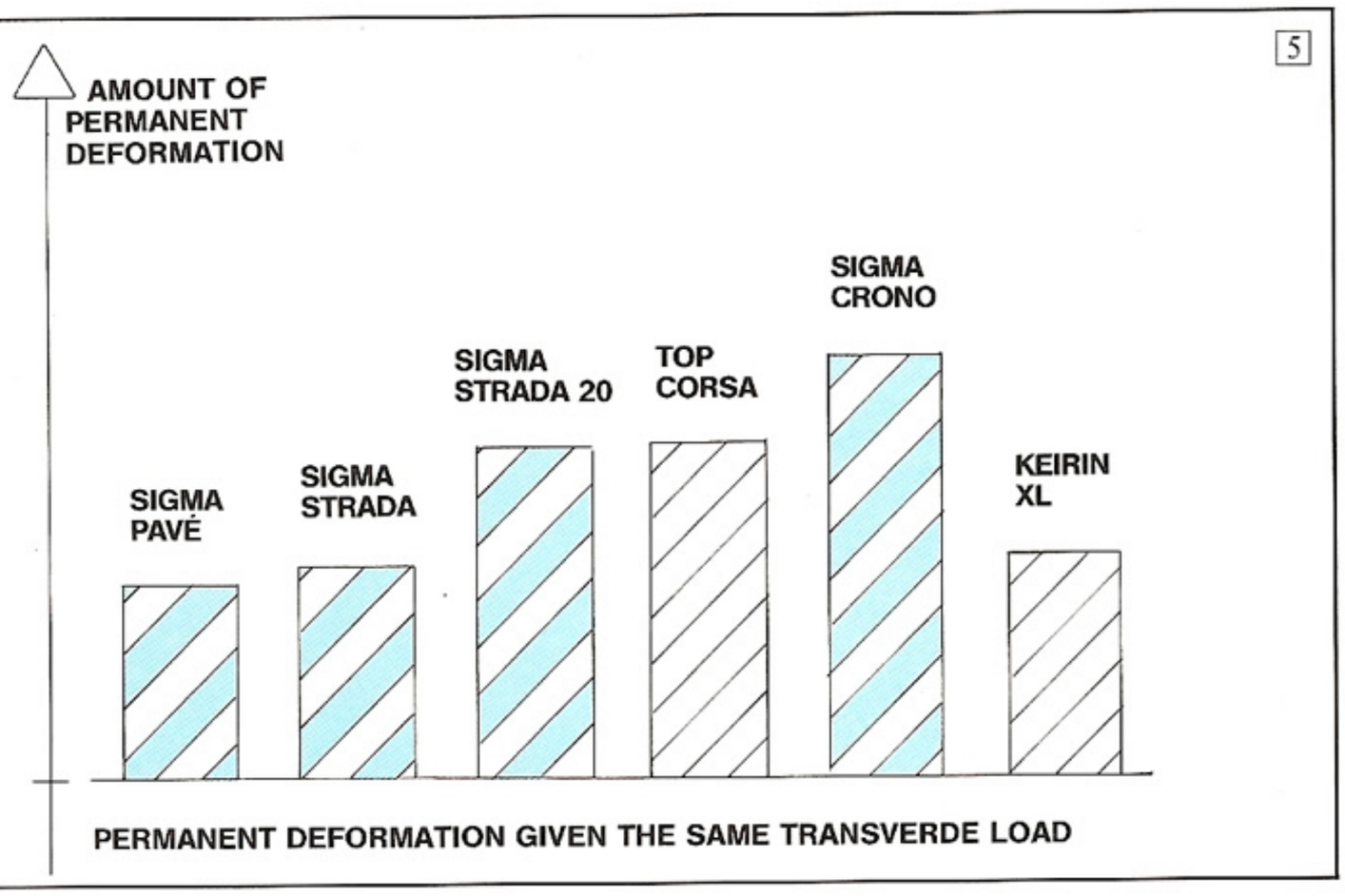
The capacity to absorb transversal stresses (figs. 5-6-7) directly affects the durability of the rim's centering hold; no longer will the cyclist's mechanics spend long



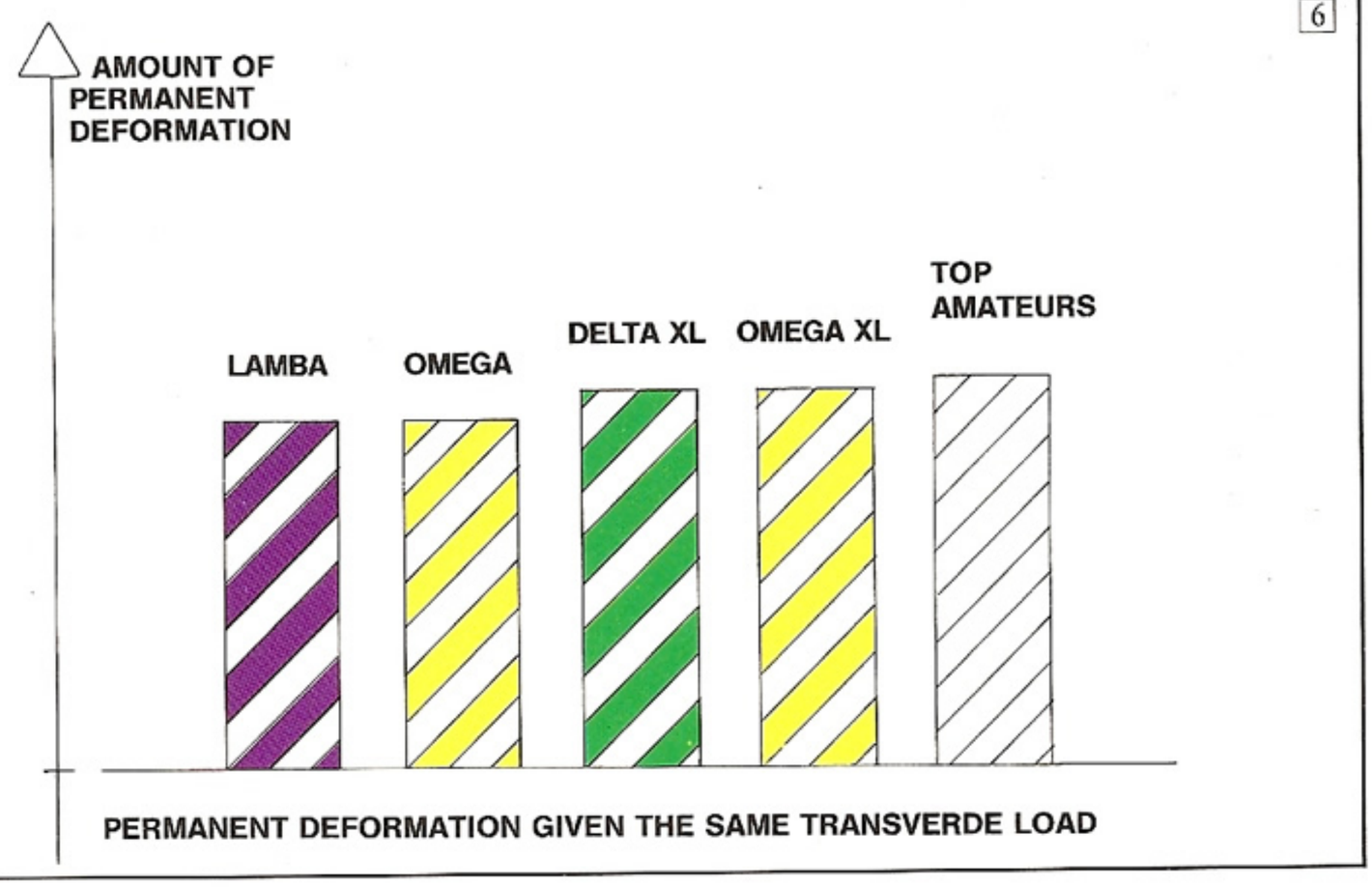
work hours re-centering all the wheels at the end of the laps run on rough roads.

The very high elastic limit (even improved in the SIGMA range) gives Campagnolo rims a very high centering reliability during the assembly phase. Thanks to Campagnolo, building a professional wheel in a few minutes will become increasingly common.

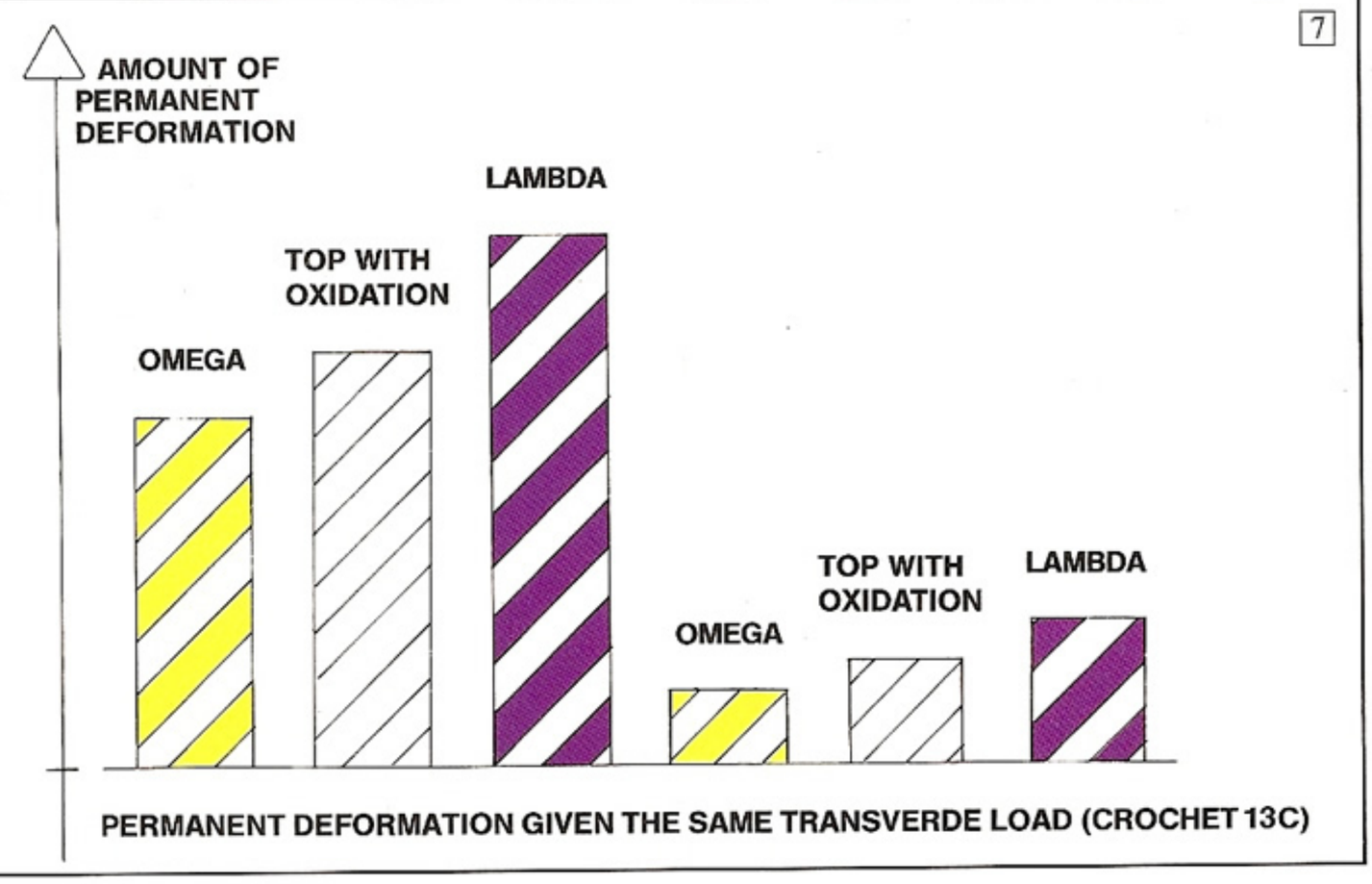
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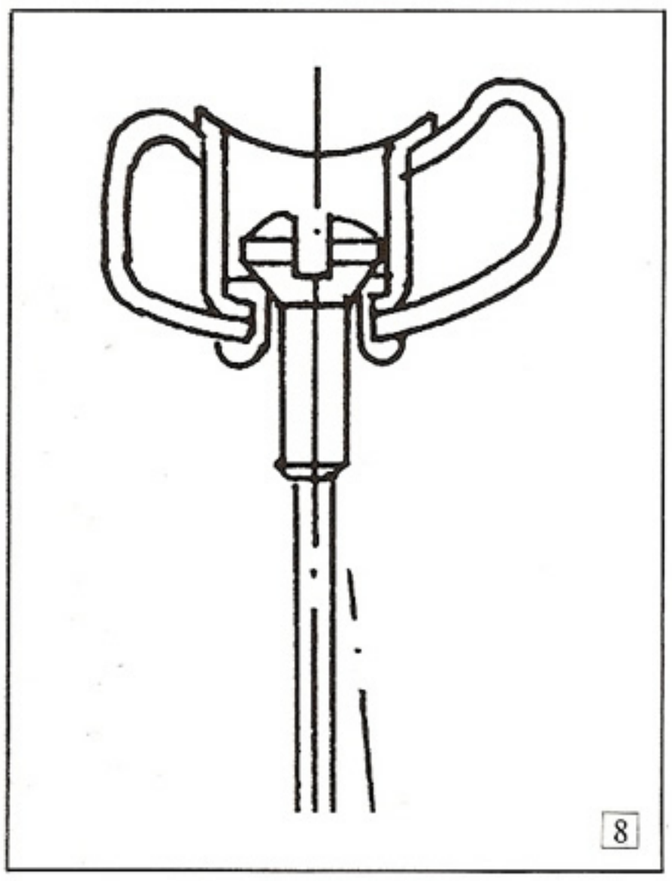
7



PATENTED POSITIONED EYELETS

Campagnolo rims feature an innovative, patented eyelet, which makes the assembly, centering and balancing of the wheel easier.

Campagnolo eyelets accept spoke nipples in a seat with double positioning, according to their working position: camber positioning, with an angle of 5 degrees (figs. 8 and 9) Campagnolo uses double eyelets coated with tropicalized zinc-plating. These enable the load to be distributed in part on the tubular seat and in part

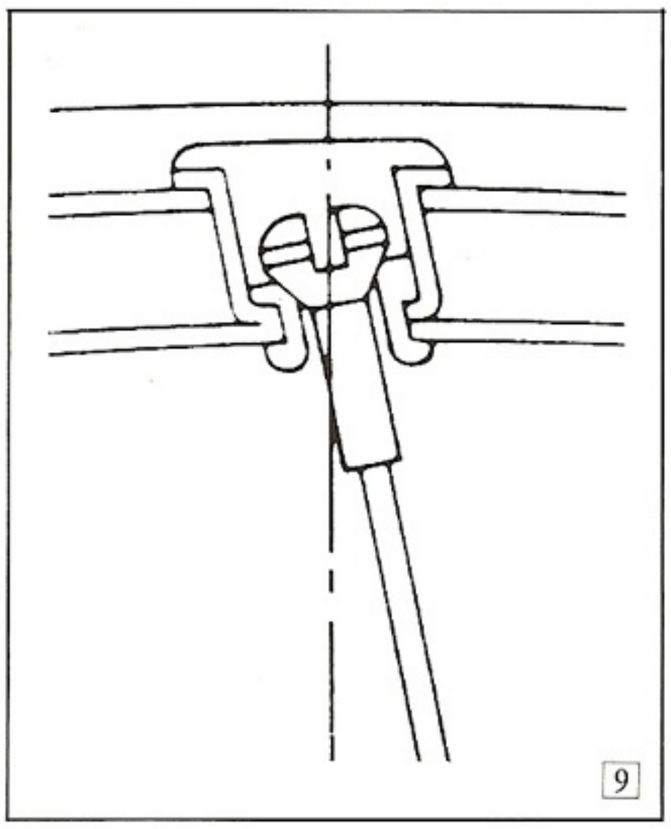


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on the internal cradle of the rim, according to a computer model of traction tests.

The design of this patented eyelet system reduces stress in the critical zones of spokes and on the hooking of the rim.

All this results in a significant reduction of broken spokes and, above all, in a safe and fast assembly and centering of the wheel, regardless of the system used.



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SURFACE FINISHINGS

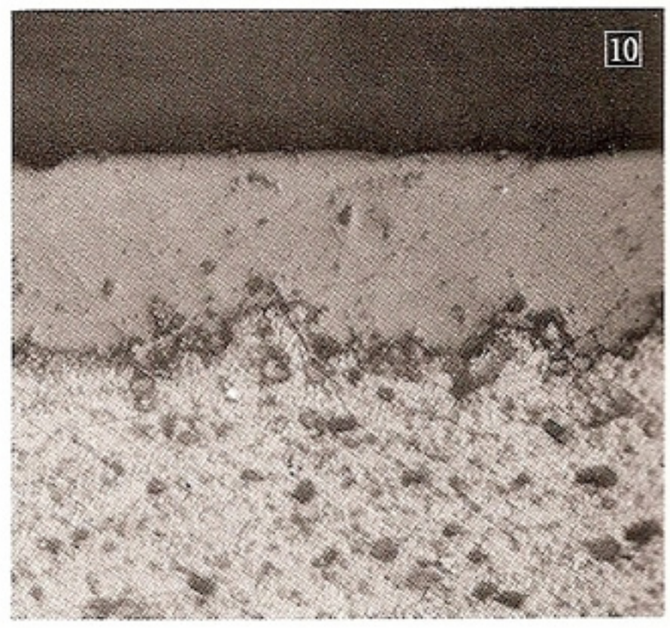
The surface finishing plays a fundamental role in the life of the rim.

Campagnolo has introduced in this rim range the "CHROMIUM", a surface treatmet much more resistent than all those used so far: the chrome galvanic treatment, directly on aluminium (fig. 10).

This is a non-decorative TECHNICAL CHROME finish which gives the rim an appearance that is more like a bar of metal than the image of the mirror-polished surface usually referred to as chromium-plating.

This finishing is used in car and motorcycle engines to coat the cylinders undergoing extremely high stresses due to the friction of the pistons compression rings.

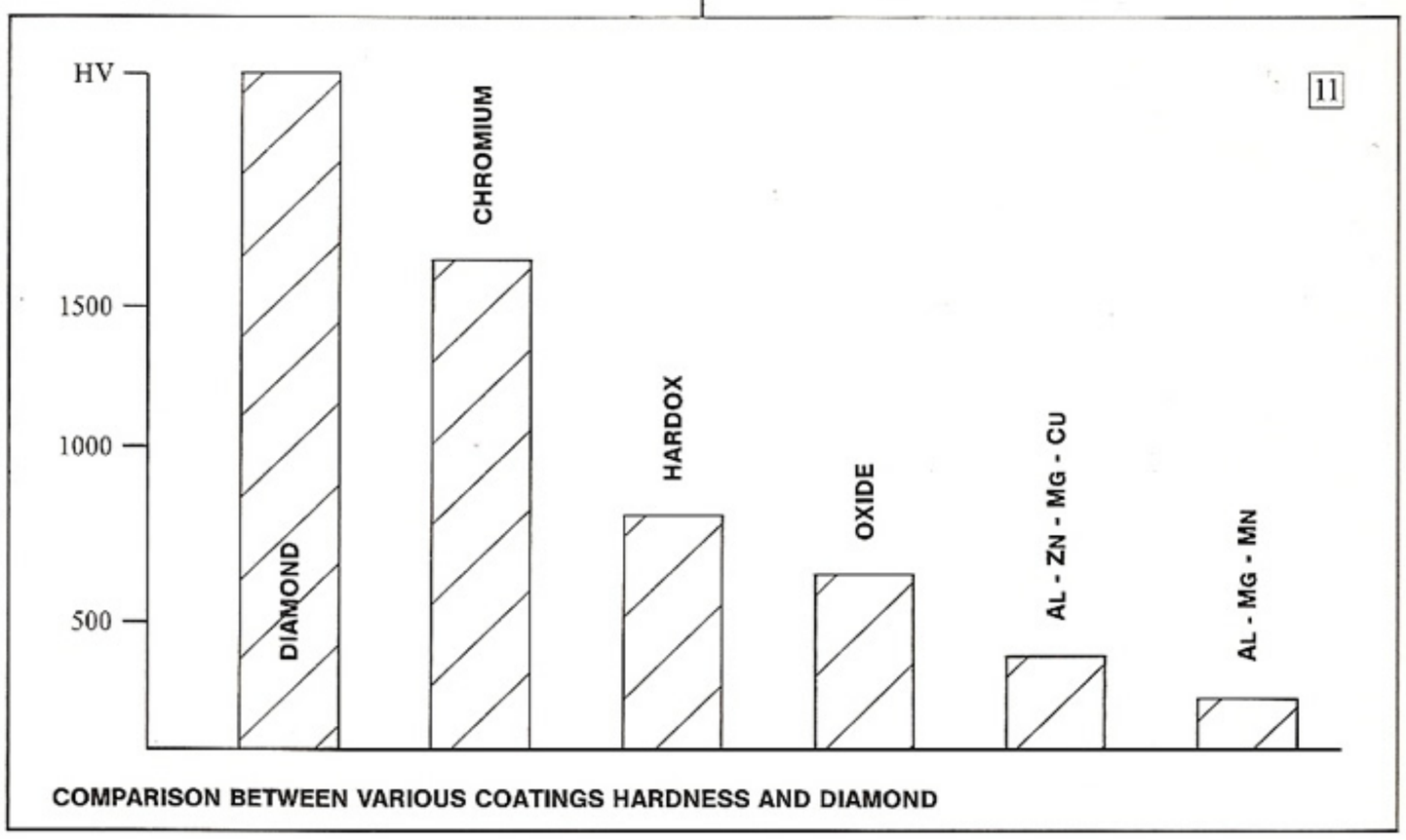
The comparison between "CHROMIUM" treatment and anodic oxydation gave, in wear tests carried out with machines simulating very bumpy roads in critical environmental conditions, the following results: after 30 brakings in areas with water mixed with sand, the best anodic oxidations available today were damaged, while it took 600 brakings to start damaging chromed rims in the same environment.



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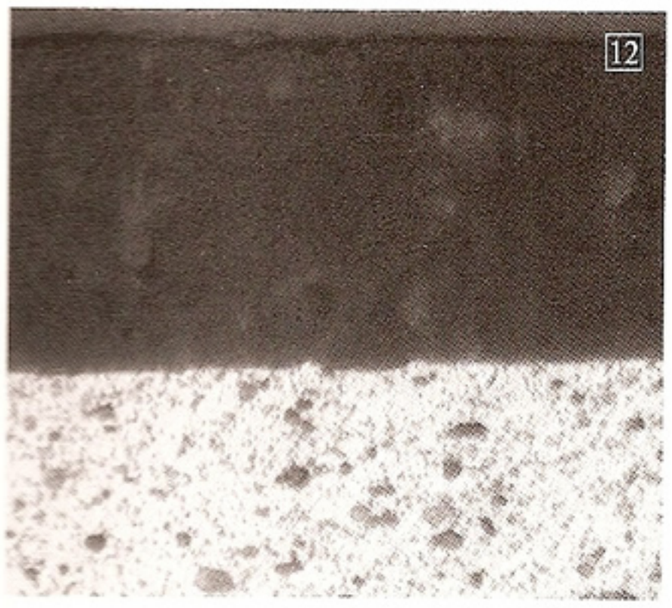
For those who take cycling seriously, our "CHROMIUM" treatment allows the rims to be kept in perfect condition for the whole season even in adverse weather conditions or seaside locations where the air is damp and salty.

Campagnolo Rim range also has a hard anodized finish (fig. 12) with its characteristic dark color



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COMPARISON BETWEEN VARIOUS COATINGS HARDNESS AND DIAMOND



and a transparent anodized finish which leaves the rim its natural color.

These treatments have a high resistance in use, as shown in diagram (fig. 11).

CROSS-SECTION DESIGN

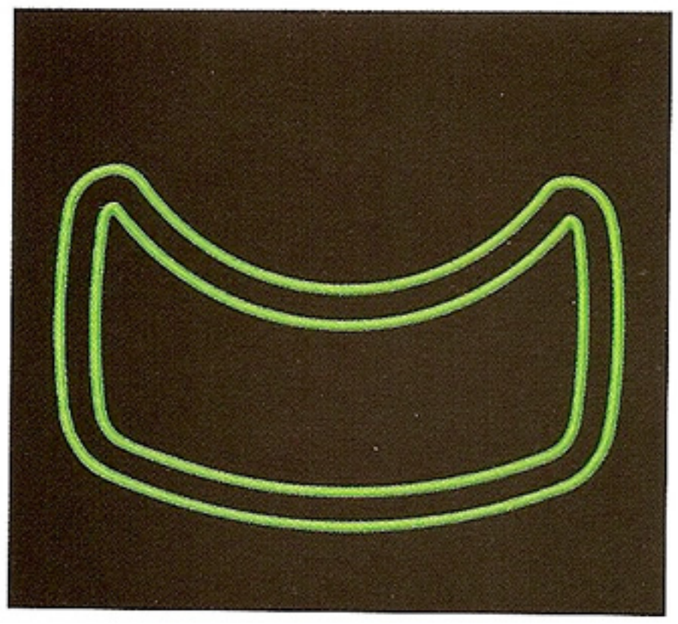
The study of a rim's cross-section is the most delicate and complex part of the whole design phase. The cross-section of the rim determines its transverse rigidity, vertical elasticity, and weight. In oder to scientificly study rim characteristics Campagnolo's Research and Development Department operates with the assistance of a computer. Using advanced CAD system, Campagnolo engineers can



quickly evaluate the correspondance between design hypothesis and ultimate goals.

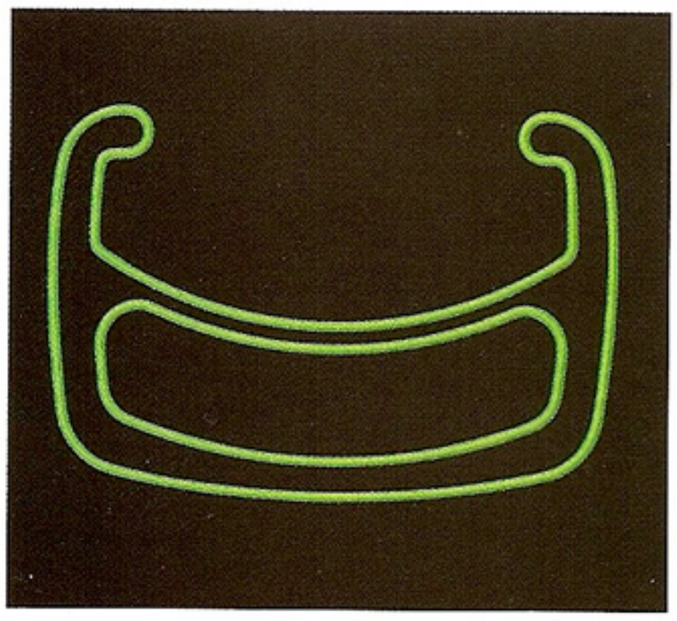
A non-shaped 19.4 mm, aluminium tube weighing 400 gr. with a wall thickness of 1.3 mm will have a value of 100 for both vertical and transverse rigidity. If the same tube is processed and shaped according to any one of the cross-section designs for tubular tires the vertical and transversal rigidity values become 38 and 112 respectively. In other words, the rim becomes more comfortable (vertical rigidity 38 instead of 100) and more resistant to transverse thrust (112 instead of 100).

For tubular tire rims, Campagnolo engineers searched for ideal

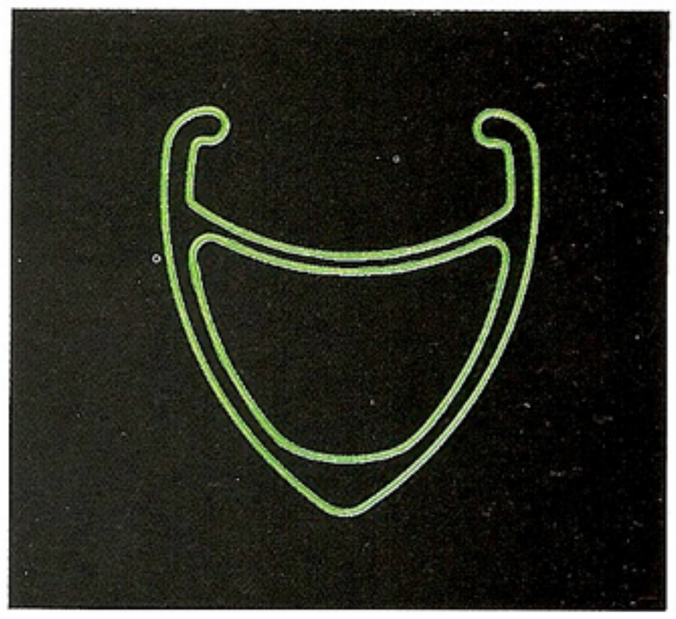


cross-sections, depending on the intended use of the rims, with the aim of obtaining the lightest possible weight, maximum transverse rigidity and optimum vertical elasticity. The cross-section was then calibrated for each rim, considering the optimum distribution of material and the mechanical effects of various geometric shapes.

The cross-section design for clincher tire rims is just as important as it is for tubular rims with the additional consideration of the rim's ability to hold the tire bead at pressure above 100 PSI.

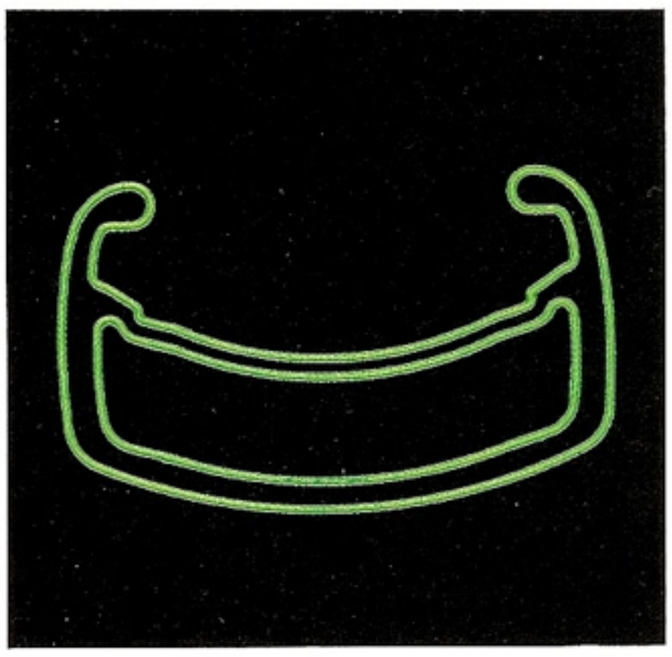


The tire bead area of clincher tire rims is critical not only to ensure that tire will remain seated when inflated to high pressure but that the inner tube has no chance of being "pinched" because of rough areas of poor bead design. Campagnolo's design also considers the problems associated with tire mounting. Poor design here can make mounting todays Kevlar or Steel beaded tires a chore. In order to make it easier to inset the whole circumference of the tire in the rim seat, Campagnolo engineers have given a great deal of attention to the depth and radius of the rim bed because the tire bead leans and runs on this area when being mounted.



Computer design coupled with wind tunnel testing has enabled Campagnolo to design an aerodynamic rim whose profile ("V Profile") prevents the breakaway of air flow (turbulance). In comparison to a rim with a normal cross-section the special sidewall camber of this Campagnolo's rim substantially reduces the effort required to penetrate air.

Of all the components in common, during a comparative test carried out in the wind tunnel at 50 km.p.h., the "V Profile" fitted offered aerodynamic resistance 30 gr less than the 300 gr absorbed by a traditional rim. This type of rim must be fitted with 6/8 mm shorter spokes.



The diffusion of clincher tires for professional contests, in multi-stage and linear races, is hindered by three basic factors:
a) weight
b) transverse rigidity
c) comfort, which is less than that offered by tubular tires.

In this research, Campagnolo have designed a 22 mm wide cross-section for DELTA XL Strada and OMEGA XL Strada rims; along with the weight, which is reduced by 18%, with the increased lateral rigidity and greater vertical flexibility, this satisfies the requirements of linear and stage races.

CAD brought to light important fundamental features which enabled Campagnolo to achieve their aims with optimization of the distribution of material with relation to the stresses and loads imposed by the effort of the athlete, who submits the whole structure of the rim to stress, demanding an efficient response and total reliability.

For practical and functional reasons, a cradle for holding the 16 mm nipple protection ring has been included in the design to prevent it from being fitted out of line.

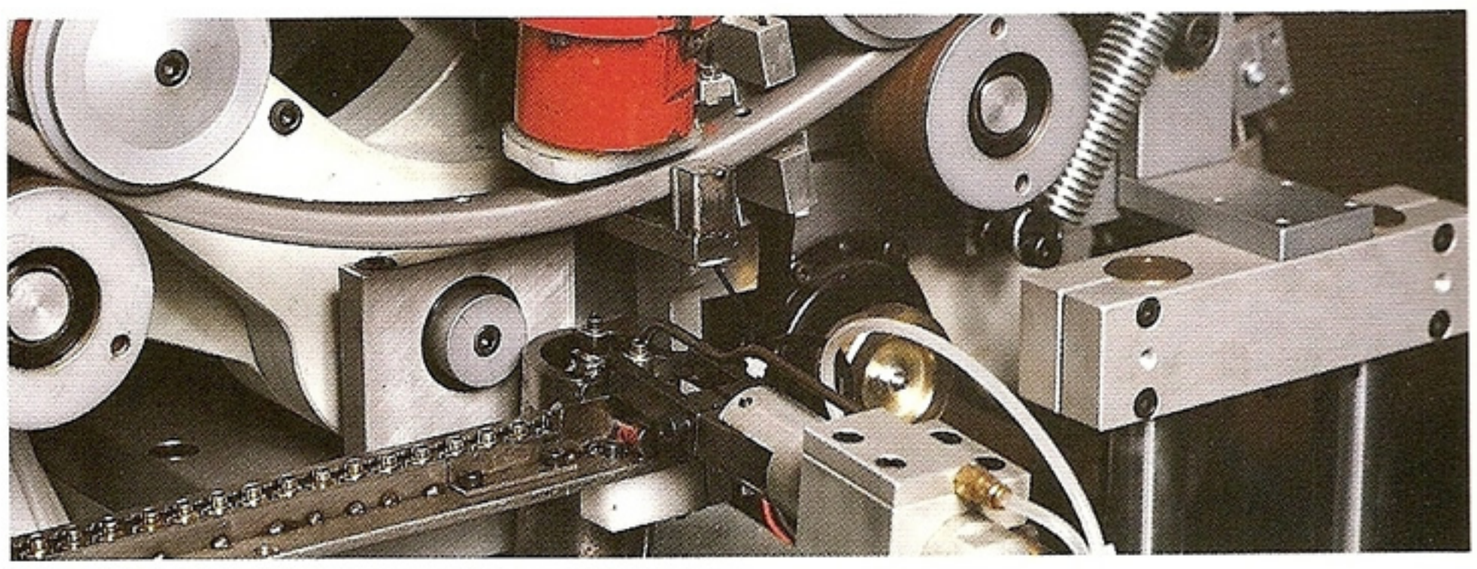


THE SAME QUALITY FOR ALL RIMS

Each series of rims, from SIGMA to LAMBDA, even if designed to meet a particular need, has been developed using the same quality, the same engineering, the same production methods and has undergone the same rigorous quality control tests.

This industrial policy called for a long, careful examination of compatibility and optimization not only of the materials used but also of the production processes and design.

Today, thanks to our intensive research, the most technologically advanced, highest quality rims are available for all cyclists-Campagnolo Rims.



SIGMA

Campagnolo SIGMA rims have been created by the experience achieved through years of races on every road and track in the world, and meet all competitive requirements.

The material utilized, Ergal, an aluminium zinc alloy used in aeronautics, has a very high elastic limit (54 Kg/mm^2) and a remarkable breaking load (62 Kg/mm^2).

In project design, the highest consideration was given to the rigidity/elasticity combination in order to ensure the trueness of the rim and its ability to withstand deformation under stress, including absorption of impacts.

Thanks to the technology and choice of the material, Campagnolo SIGMA rims can easily be trued, this saves mechanics hours of wheel adjustment after a race.

Patented eyelets, positioned according to the camber and the crossing, are safer with regards to the duration of spokes, remarkably reducing the possibilities of breakage in the most critical zones.



CAT.NO.	TYPE	FINISH	DIAMETRE	DRILLING	WEIGHT ~ gr	WIDTH mm.	THICKN. mm.	EYELET	TIRE
P0061	SIGMA Pavé	Chromium	28" (700 C)	24-28-32-36	365	22	1.1	Double patented positioned eyelet	Tubolar
P0071	SIGMA Pavé	Hardox	28" (700 C)	24-28-32-36	365	22	1.1	Double patented positioned eyelet	Tubolar
P0081	SIGMA Strada	Chromium	28" (700 C)	28-32-36	335	22	1.0	Double patented positioned eyelet	Tubolar
P0091	SIGMA Strada	Hardox	28" (700 C)	28-32-36	335	22	1.0	Double patented positioned eyelet	Tubolar
P0111	SIGMA 20 Strada	Hardox	28" (700 C)	28-32-36	345	20	1.1	Double patented positioned eyelet	Tubolar
P0121	SIGMA Crono	Oxide	28" (700 C)	24-28-32-36	285	20	0.9	Double patented positioned eyelet	Tubolar
P0241	SIGMA Crono	Oxide	26" (650)	24-28-32	265	20	0.9	Double patented positioned eyelet	Tubolar
P0253	SIGMA Keirin	Oxide	28" (700 C)	36	285	20	0.9	Double patented positioned eyelet	Tubolar
P0263	SIGMA XL Keirin	Oxide	28" (700 C)	36	260	20	0.8	Double patented positioned eyelet	Tubolar

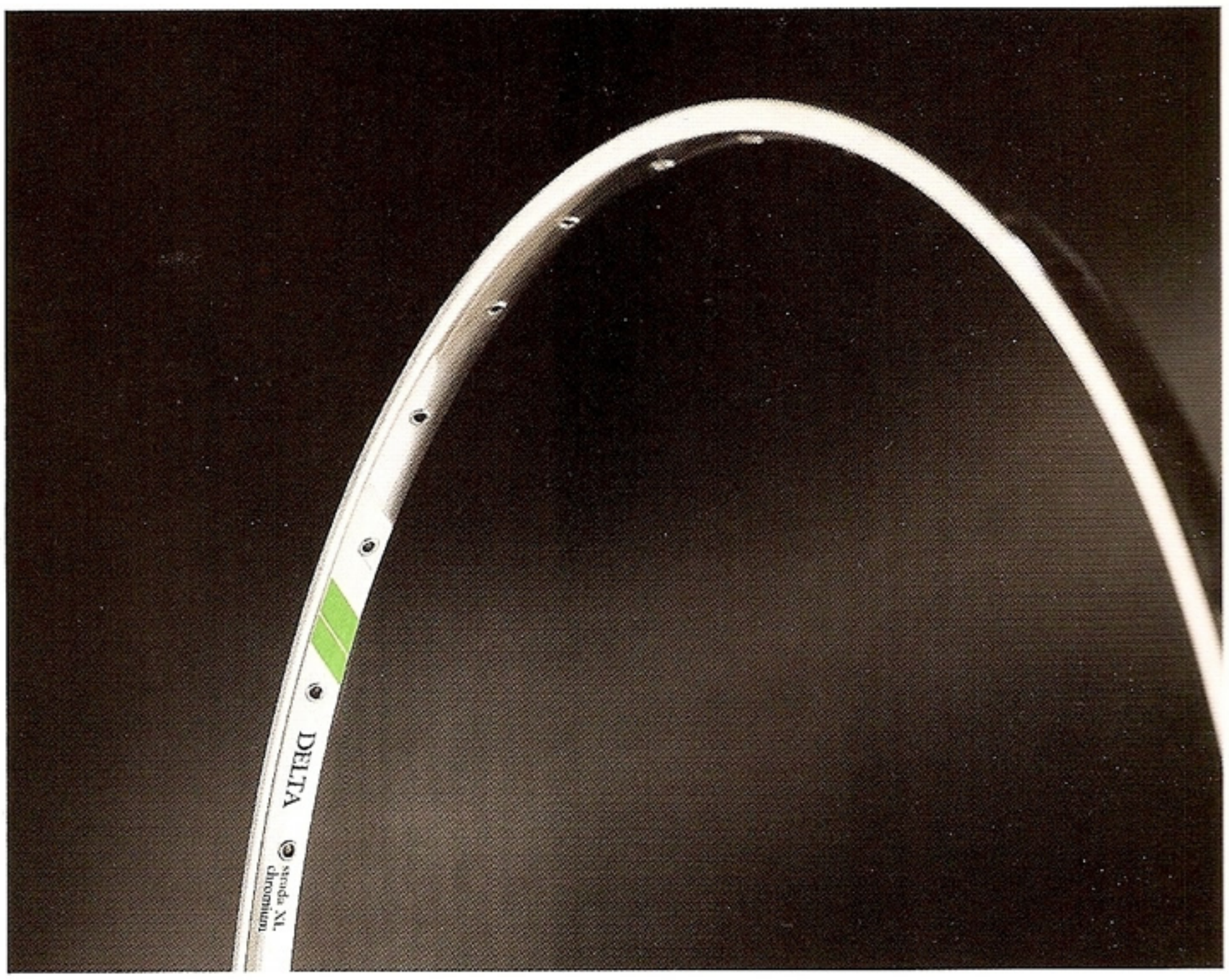
The weights are for rims without eyelets. Weight of one eyelet: 1,52 gr.

DELTA

For its DELTA line of rims, Campagnolo uses a special aluminium alloy with a very high elastic modulus and breaking load level. This provides unsurpassed reliability and gives the rim a "memory" making wheel building and truing surprisingly easy. During the design phase of the DELTA rim great importance was placed upon creating a rim that would not only be light weight but also be very resistant to wear. In order to realize these design goals, Campagnolo selected a wall thickness of 1.2 mm and galvanically surface treated the rims with chromium. The results are a 405 gr rim (with 32 eyelets) whose surface is practically unalterable with time and use.

TUBULAR RIMS: the weight of the DELTA XL Strada rim makes it the ideal choice for competitive use on all kinds of road surfaces and weather conditions. Its lightness is also an important characteristic for stage races and mountain courses. Due to its chromium surface treatment it has an exceptional resistance to the corrosive action of such atmospheric agents as: sand, rain and salt making it very suitable for the Triathlon, a speciality which exposes the bicycle to particularly harsh environmental conditions.

CROCHET (13C): the DELTA XL Strada rim for clincher tires is a special 22 mm rim designed for professionals. This superb clincher tire rim offers the degree of comfort necessary for long distances and hours in the saddle.



CAT. NO.	TYPE	FINISH	PROFILE	WIDTH mm.	DRILLING	WEIGHT ~ gr	EYELET	TIRE
P0141	DELTA XL Strada	Chromium		20	32-36	360	Double patented positioned eyelet	Tubolar
P0142	DELTA XL Strada	Chromium		22	28-32-36	360	Double patented positioned eyelet	Clincher 19-25

The weights are for rims without eyelets. The rims with Crochet profile (13C) can have weight increase of max 3,5%. Weight of one eyelet: for tubolars 1,52 gr., for clinchers 1,14 gr.

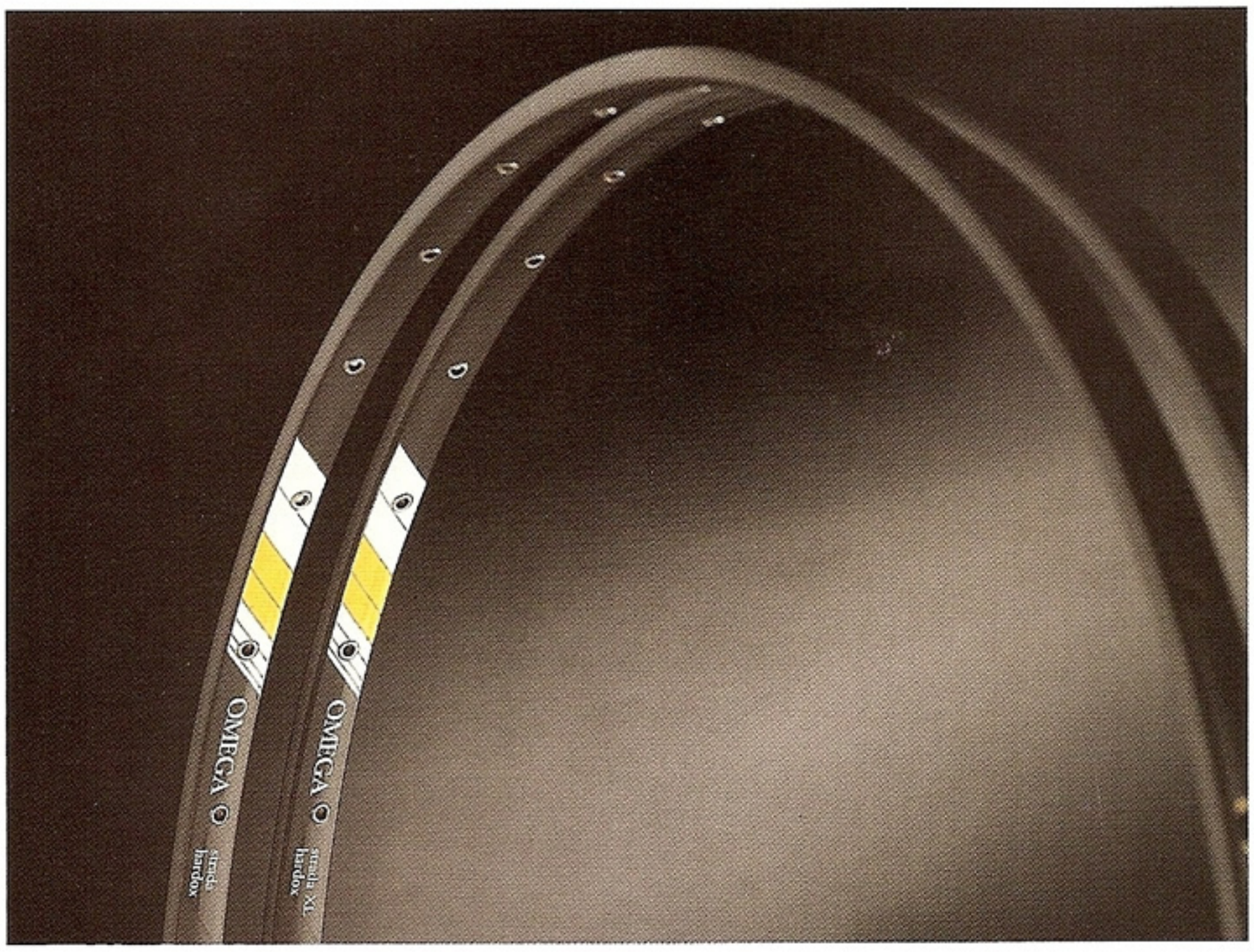


OMEGA

The Campagnolo OMEGA rims were designed to satisfy the needs of the most advanced cycling amateurs and are available in models for both clincher and tubular tires.

TUBULAR RIMS: in this case, Campagnolo has applied the technology developed for its competition rims, thus giving OMEGA the sporting characteristic loved by bicycle fans.

The material used is the same used for DELTA rims: it gives high reliability. An effective, layered hard anodization finish gives the rim its characteristic burnished color. The OMEGA XL rim responds very well to short and continuous stress typical of uphill or amateur races.



CAT. NO.	TYPE	FINISH	PROFILE	WIDTH mm.	DRILLING	WEIGHT ~ gr	EYELET	TIRE
P0161	OMEGA XL Strada	Hardox		20	32-36	360	Double patented positioned eyelet	Tubolar
P0171	OMEGA Strada	Hardox		20	32-36	395	Double patented positioned eyelet	Tubolar
P0162	OMEGA XL Strada	Hardox		22	28-32-36	360	Double patented positioned eyelet	Clincher 19-25
P0222	OMEGA Strada "V Profile"	Hardox		20	28-32-36	425	Without eyelets	Clincher 19-25
P0172	OMEGA Strada	Hardox		20,2	32-36	415	Double patented positioned eyelet	Clincher 19-25

The weights are for rims without eyelets. The rims with Crochet profile (13C) can have weight increase of max 3,5%. Weight of one eyelet: for tubolars 1,52 gr., for clinchers 1,14 gr. - N.B. "V Profile" rims are supplied without eyelets.



CROCHET (13C): OMEGA rims for clincher tires come in two versions, normal box-section or "V Profile". They are both made of the same heat treated Mg-Si aluminium alloy so their stregth is equal but because no spoke eyelets are used for the model with "V Profile", it is a few grams lighter. The HARDOX anodization which increases the superficial hardness of the rim and the heat treatment which improves the mechanical strength of the material combine to give OMEGA clincher tire rims unparalleled reliability.

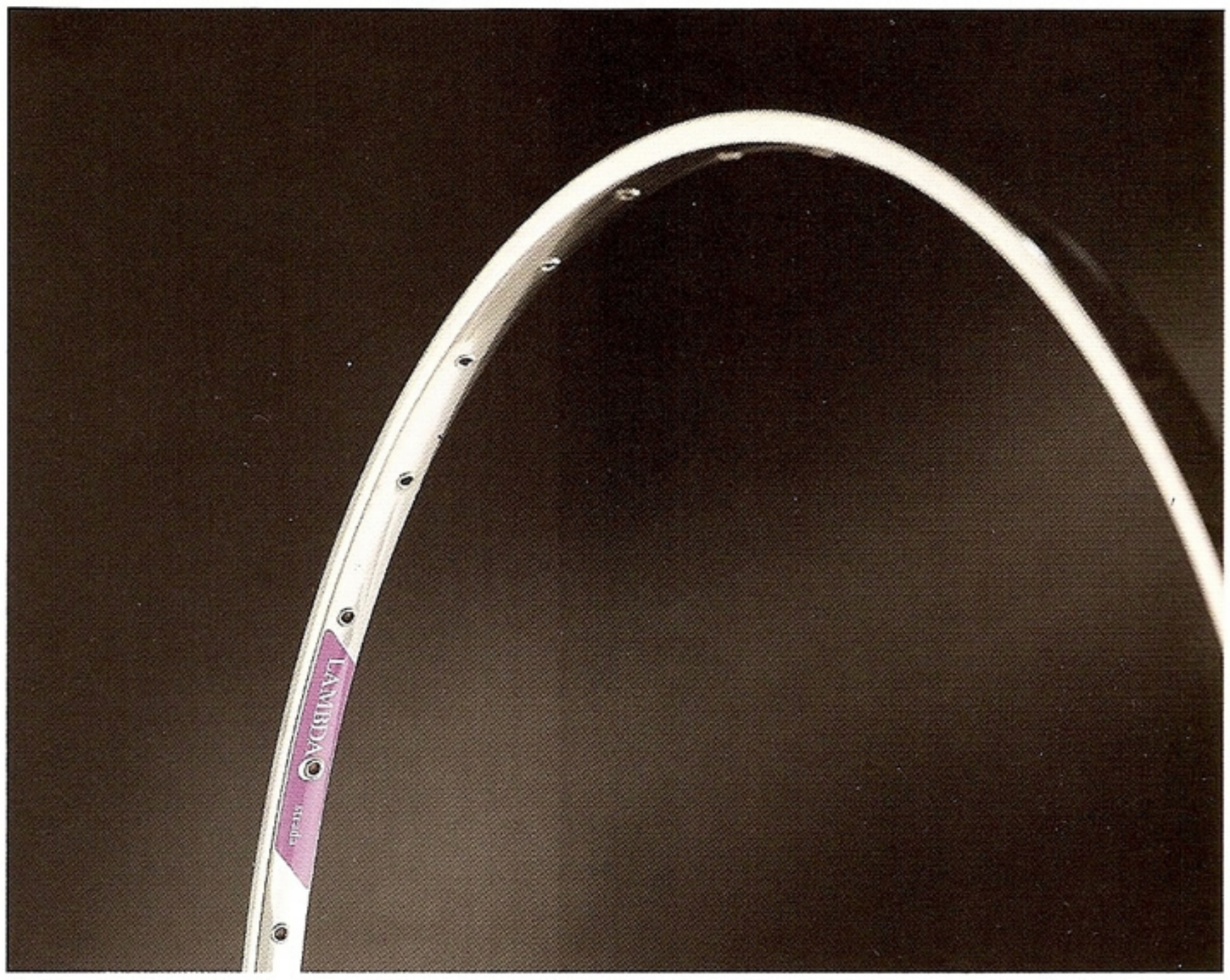
LAMBDA

Campagnolo LAMBDA rims are also produced in clincher and tubular versions.

TUBULAR RIMS: from a technological point of view, LAMBDA tubular rims are similar to those designed for all-out competitive use but without the high price normally associated with such technology.

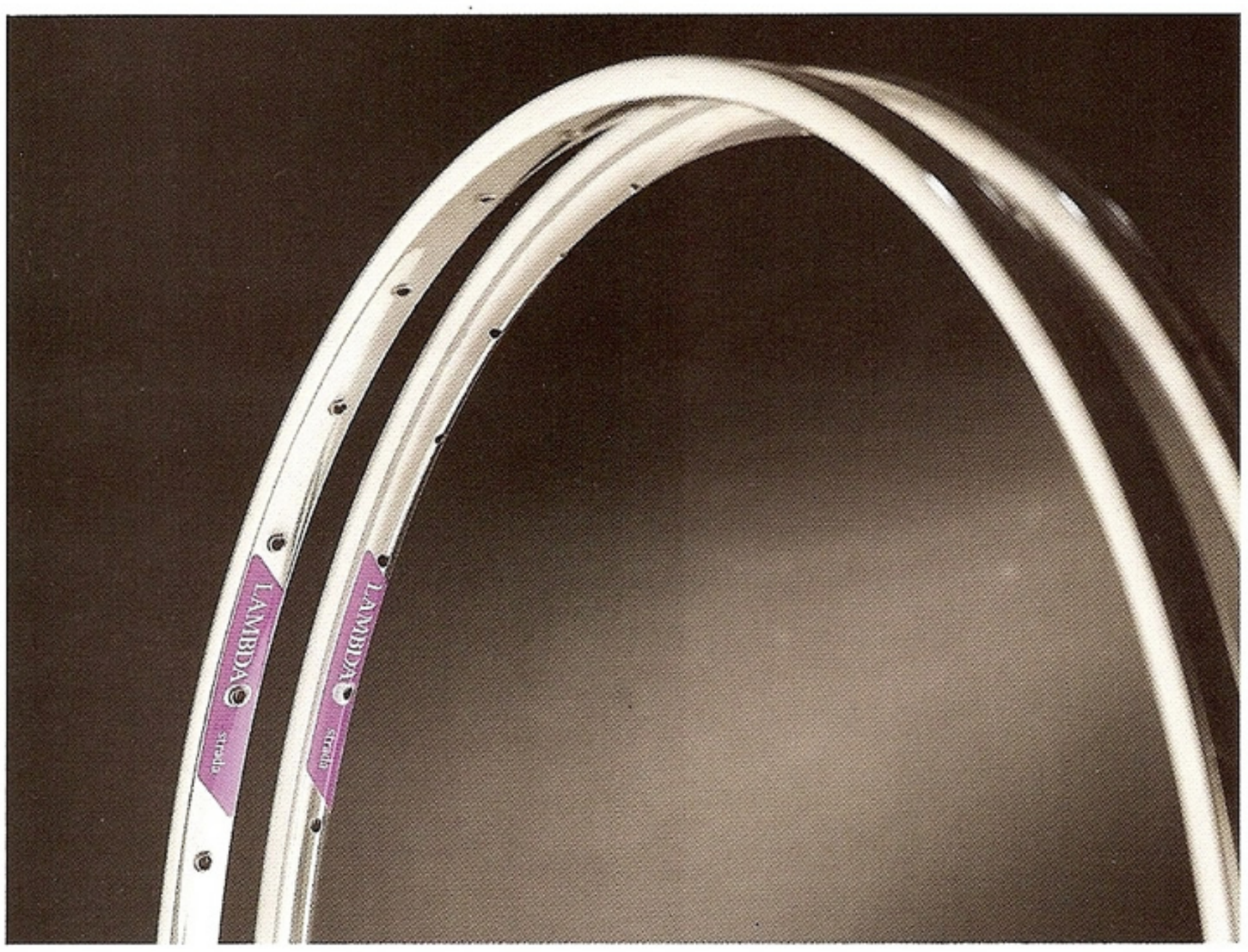
The patented Campagnolo eyelet is mounted on the LAMBDA rims as well.

The aluminium/magnesium alloy used has an elastic module of 7100 Kg/sq mm. This allows machine centering and balancing of the wheel without problems. The mechanical characteristics of the material and the profile projected for the LAMBDA rims give these products a capacity to absorb impacts which is essential for comfort.



CAT. NO.	TYPE	FINISH	PROFILE	WIDTH mm.	DRILLING	WEIGHT ~ gr	EYELET	TIRE
P0211	LAMBDA Strada	Polished		20	32-36	395	Double patented positioned eyelet	Tubolar
P0232	LAMBDA Strada "V Profile"	Polished		20	28-32-36	425	Without eyelets	Clincher 19-25
P0212	LAMBDA Strada	Polished		20,2	32-36	415	Double patented positioned eyelet	Clincher 19-25

The weights are for rims without eyelets. The rims with Crochet profile (13C) can have weight increase of max 3,5%. Weight of one eyelet: for tubolars 1,52 gr., for clinchers 1,14 gr. - N.B. "V Profile" rims are supplied without eyelets.



And it does this without compromising the security of the hold and the non-deformability of the rim.

CROCHET (13C): LAMBDA rims for clincher tires, just like their OMEGA counterparts, are designed in two versions: with normal and "V Profile" and these new Campagnolo rims use the same heat-treated aluminium alloy normally found in rims costing twice as much. This superior aluminium alloy combined with Campagnolo's ultra-modern manufacturing technique guarantee that wheels built with LAMBDA rims will look and perform like new for months to come.

OMICRON

These rims with double eyelet have an ideal performance for cycletouring.

They have been designed for OEM with robot assembling.

The OMICRON rims are so strong that can bear additional loads.

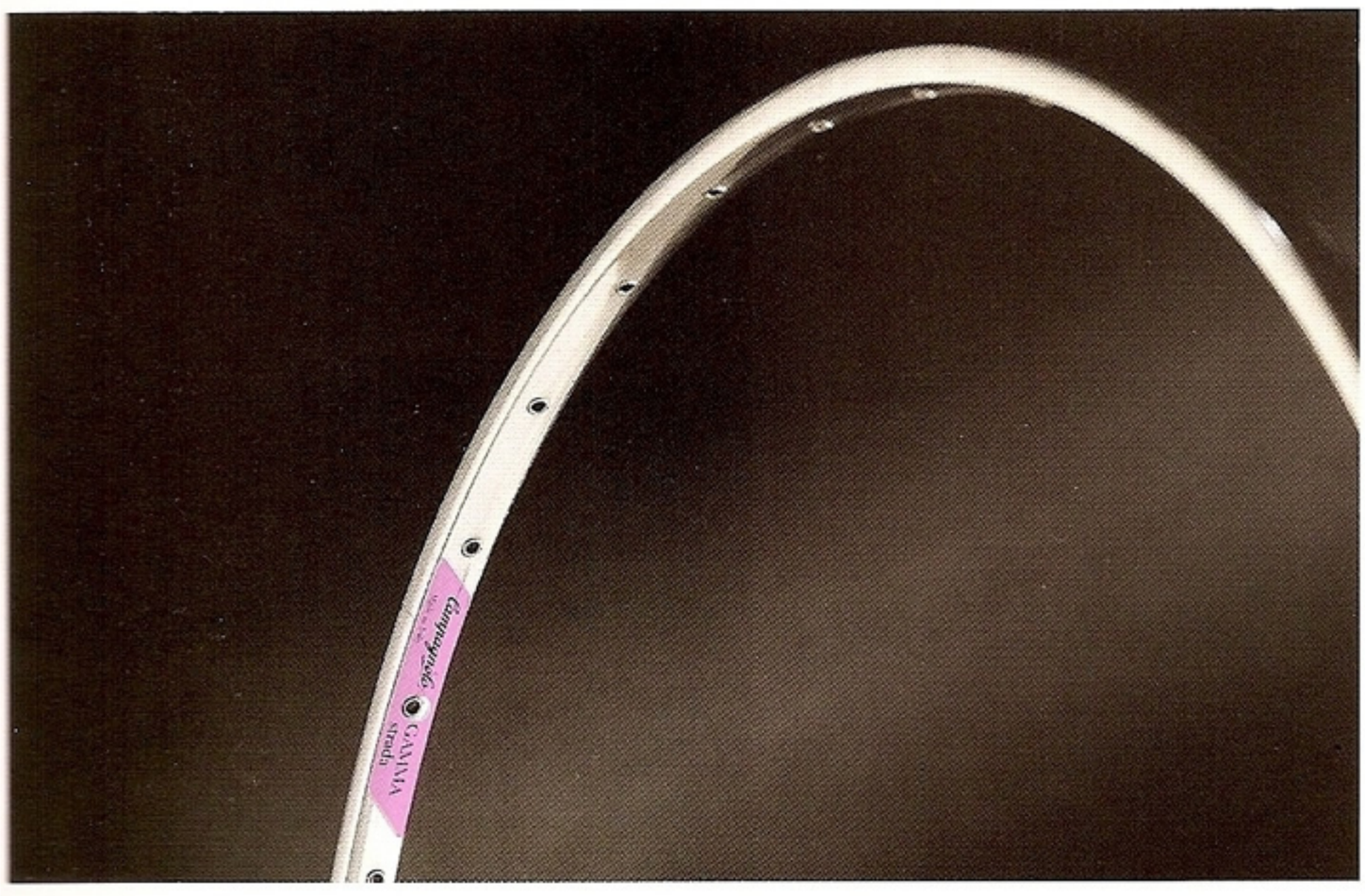
They are heat treated.



CAT. NO.	TYPE	FINISH	PROFILE	WIDTH mm.	DRILLING	WEIGHT ~ gr	EYELET	TIRE
P0272	OMICRON	Polished		20,2	32-36	465	Double patented positioned eyelet	Clincher 19-25

The weights are for rims without eyelets. The rims with Crochet (13C) profile can have weight increase of max 3,5%. Weight of one eyelet for clinchers 1,14 gr.

GAMMA



The GAMMA rims are reserved to OEM.

Their characteristics, and a good quality/price advantage have been studied for the automatic assembling too.

These rims have a well-balanced transversal and vertical rigidity which gives to the wheel a steady bedding out of the assembling robot.

GAMMA rims are heat treated.

CAT. NO.	TYPE	FINISH	PROFILE	WIDTH mm.	DRILLING	WEIGHT ~ gr	EYELET	TIRE
P0282	GAMMA	Polished		20,2	32-36	465	Single eyelet	Clincher 19-25

The weights are for rims without eyelets. The rims with Crochet (13C) profile can have weight increase of max 3,5%.

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