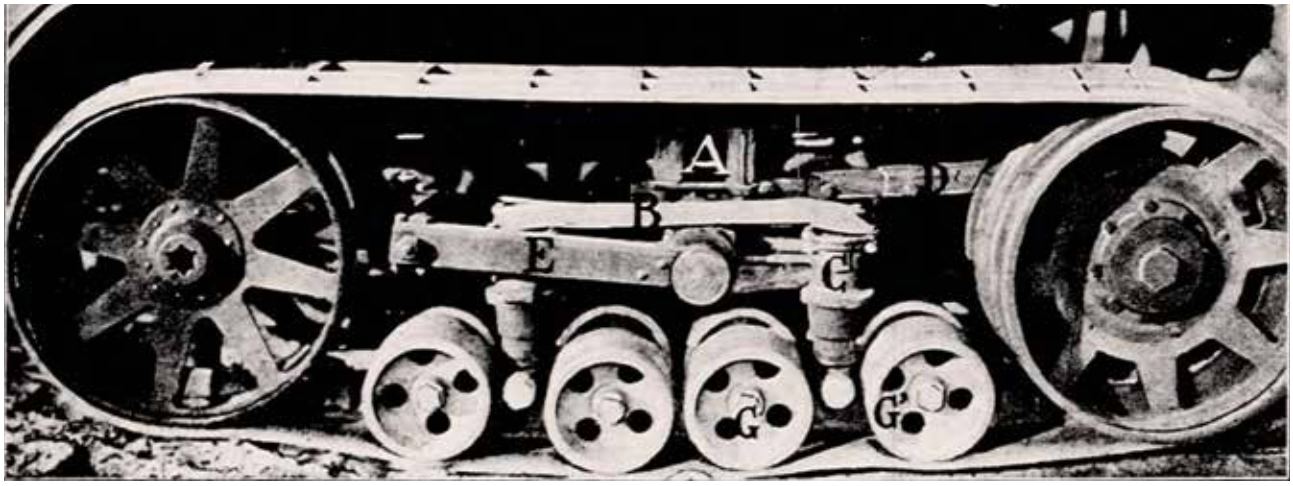
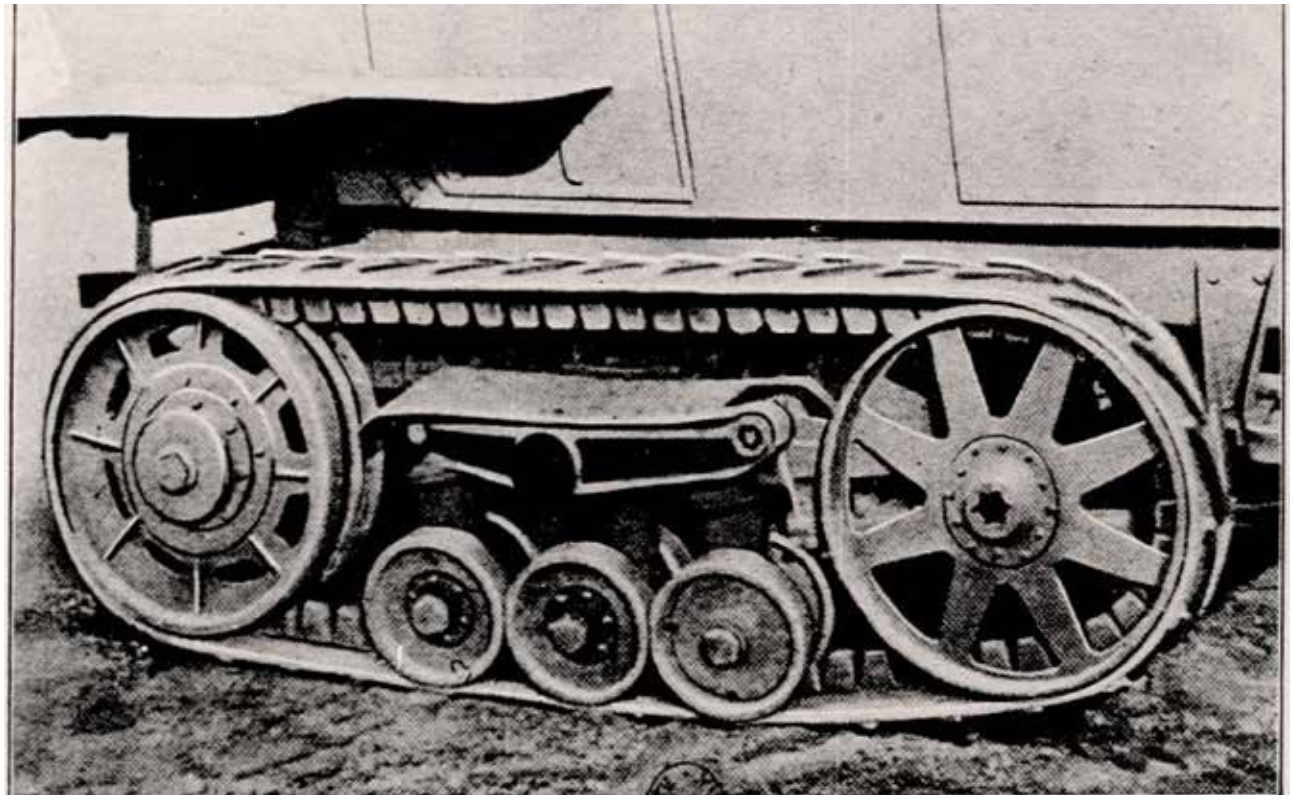


Model Nèige

THE FLEXIBLE RUBBER TRACK on Citroën Kegresse-Hinstin

Motor cars trial experiments on snow, in the Alps, February 1922

Model Tous Terrains Short



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THE FLEXIBLE TRACK CARS
Kegresse-Hinstin Motor cars trial experiments on snow, in the Alps, in February 1922

The competition organized by the Automobile Club, "Touring Club" and the "Alpine Club", was open to all the French-built vehicles Who was able to drive on the snow by any kind of propulsion (wheels, skates, caterpillars, aerial propellers, etc.).
The trial should include the following:

1. A drive test on mountain road over a hundred kilometers in length, both covered roads unplowed snow or partially cleared only on roads without snow.

2. A test maneuver on snow field.
Two applications of engagement had only been presented, Tune the house André Citroën Department the deceased appliances; the other by Mr. Joeelyn Emile Ollivier, Saint-Gervais (Haute-Savoie). the last competitor had to removables skis in front and removable wheels belts lined studs hinged at the rear, but he withdrew at the last moment.
The only cars that took part in the competition were, five production cars model 10 HP Citroën, equipped with the Kegresse-Hinslin tracks with re-

movable skis in the front wheels.
A sixth service car similar the first also followed the contest.
Cars of this type had already taken part-one year before, exactly, to mountain tanks contest at the Mount Revard (altitude 1.500 m), near Aix-les-Bains, by the Automobile Club de France.
The cars of the 1922 contest will differ those of Mount Revard contest by a few minor changes (improvements, enhancments, breaks). Apart from the development of the structural system, it must signal the brake control caterpillars by management (device described below), which did not exist, not in 1921, and the improving cooling system. The latter was obtained by adding the radiator of a larger area placed to the top of the hood and provided with in direct contact with the air. In addition, in difficult ascents and passages, the hood can be kept partially raised. (see photo 3) so as to allow the circulation of fresh air around of the engine itself. Thanks to these improvements, radiator water can be used indefinitely.

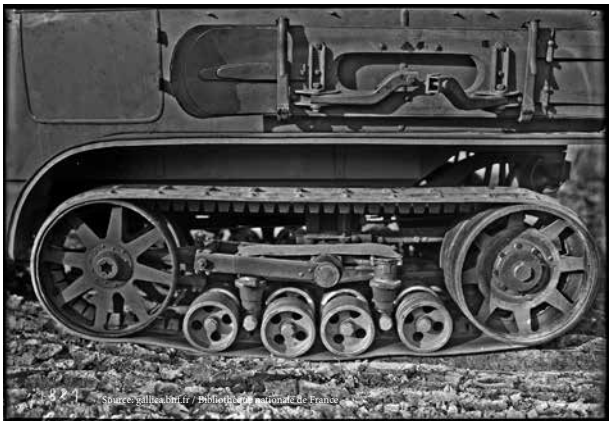
The following will give a detailed

description of propellant.
The route to be traveled by competitors was next:

1. stage - Annecy Chambéry, by collar Injure and Plaimpalais (53 km);

2. stage - Chambery to Saint-Pierre-de-Chartreuse, through the passes of Ash and Cucheron (36 km);

3. stage - Saint-Pierre-de-Chartreuse in Grenoble, by the collar of Gateway and Sappey (about 35 km).
Three was send by rail to Grenoble had traveled the way back before the contest, the other three cars landed directly in Annecy yesterday.



The pass roads had been partially cleared for snow to Ponts et Chaussées, except Cucheron and Col de Porte where Snow was still fresh following a recent fall.
The three steps are made without any difficulty and without incident. As there was a only competitor, the six cars remained in convoy, without seeking to realize the top speed. All members of the jury could sit in the cars for two steps over three and some throughout contest, which allowed a very safe control.

Depart from Annecy at 8 am on 7th. February, the convoy arrived at 12,30 at Chaiwbéry after stops of various causes and making 5o minutes delay in total.
The klimbing of the pass of Leschaux from the junction of the road near Lake Annecy was made in about an hour for a distance of 12 km and a level difference of 450 m (lake, 450; col Leschaux, 900).
Below 800 meters in altitude, there had no snow. They found 0,60 m of snow at the pass Leschaux and 1 m at col Plaimpalais. On road, partially cleared by Ponfs et Chaussées, ordinary car could, go to col Leschaux, but not that of Paimpalais.
From 1.000 meters, the wheels were spinning and a car could not go up.

the Snow cars was rather without any difficulty. It was not even necessary to place the skis to the wheels before that day. On the descent of the col Plaimpalais in Chambery, close to the "Deserts" in 1.000 m, we met a car alpine car P.L.M. who came from Annecy by roads with some jury members who had not been able to sit on the snow cars.

The 8th. February, the convoy departed from Chambéry (295 m) around 7.00 am, and had to put the skis on wheels after one hour driving, at the col du Frêne. There installation of the skis is very fast, it could be made in nine minutes to one of the cars.
Note that the skis are provided with a holes, through which the wheel pass throw, so the skis do not touch the ground and the wheels drive forward.
The skis could be left in place for the remainder of the contest until the finish, instead Grenete in Grenoble.
At the col du Frêne was 0,60 m jelly snow, but at ground altitude Cucheron (980 m), we found 1 m dry and crumbly snow a recent fall and not cleared.
The arrival in Saint-Pierre-de-Chartreuse (85o) was held without incident, After 11 hours, 68 minutes of stops to various causes (install the skis, trial in a snowfield at the col du Frêneh, block on the road).
In the afternoon of the same day held a first snowfield on trial in Saint-Hugues-de Charlrcuse. The cars went without difficulty hill pendens up to 3o%, so a hill 2 m high about which the bank had a slope of 5o%. In these various developments, the car stops and leaves without difficulty at any time and at any location.

The 9th. February, the convoy depart from Saint-Pierre-de-Chartreuse at 8:00 am, through Col de Porte (altitude 1.350) without difficulty on fresh snow not cleared and arrived at Sappey (altitude 1,000 m) at 10:00 am. There occurred a second test on field snow (average thickness 5o cm) in all witch cars renewed the same exercises: die crossing slopes up to 4o% over long lengths, passages' -ravi-ris rimmed steep slope to 5o%.
In the afternoon, the return of Sappey Grenoble (unlike dice level 800 m distance 13 km) took place in less than 4o minutes.

Description of the tracked car Kégresse-Hinstin

The System of Kégresse engineer is a caterpillar device, intended in principle to replace the rear axle of a motor Vehicule.
The engine, transmission and front of the vehicle are not changed.
The System of Kégresse consists of three parts: the carrier system, the track and the drive system.
The first two, mainly, the carrier system can differ according to whether snow cars or vehicles that can travel on all terrains.

1) Snow Cars - The structural system each side has eight half-rollers arranged on two independent lines and symmetrical connected by a combination of articulated rockers and resilient to a workpiece attached to the frame.
This part is placed so as to distribute the load at a rate of 1/5 on the front wheels and 4/5 on the caterpillars.
This piece is fixed a longitudinal balance carrying at each end two rollers divers vertical axis symmetrically corresponding to each of half pebble files. Each these cylinders, a piston whose stem is articulated to the lower part in the middle of a small pendulum resting by its ends on the axes of the two half-rollers neighbors on the same line. Each piston is supported otherwise a share of strong coil spring acting the top, not the bottom-cylinder, fool on the end small balance that penetrates in the upper part of the cylinder by a small window pierced for this purpose. This second pendulum is and on the springs of the two paired cylinders divers at the same end of the beam.
By the interplay of three sets of pendulums and springs coil, the eight half-rollers can move from each other following inequality ground and hence the caterpillar can marry its shape very easily, without charge ceases to be evenly distributed over the rollers and consequently to almost uniformly on the track. The two lines half-rollers roll on either side of the rib inner core of the track formed by the line of block guide which will be discussed further.
The track is an endless belt comparable to a belt and made like auto tires by a thick rubber strap army large canvases. This strip carries inside a median line a row of guide blocks for the drive. All of these guide blocks form a sort of rib cut

notches evenly spaced, so that the band can marry the curvature of the pulleys that support it. Each block-guide, in the shape of a truncated pyramid, contains a better quality cork neyau coated with rubber and is an absolute part of the band.
On the outer part, the caterpillar carries as soon following projections from transverse lines to ensure perfect aderence. The caterpillar is stretched between a driving pulley at the rear and a crazy pulley at the front. These two pulleys are placed so that on a flat ground, they do not touch the ground, all the weight of the back of the car bearing only the half-marks. The front pulley, which serves only tension, is carried by the end of a longitudinal stirrup hinged on the same axis as the balance B. This stirrup is provided with a rack for adjusting the tension.
By means of a lever that fits on the square of the pinion, this adjustment is done very quickly and the rack is locked in its position by a nut. The movement of the pulley downward is limited by stops that carry the front plunger cylinders. On the front pulley, there is a central groove for the passage of the guide blocks.
The Training System has a special drive pulley; in two pieces, connected to the rear axle, which is not fixed to the frame, but simply sus-

pended by two strong belts. The spacing between the axis of the rear axle and the piece A is maintained on each side by a push rod D. The outer driving half-pulley, which is wedged on the end of the differential shaft causes the half internal pulley via two inclined plane rings arranged, so that the resisting force tends to bring the two half-pulleys. The line of the guide blocks is thus clamped together and the tightening is all the more energetic by the effect of the inclined planes that the resistance to advance is more considerable. By this arrangement, the drive of the track is ensured in the case of the greatest efforts to provide, such as when braking.
The ball bearings and the drive mechanism are absolutely protected against the causes of external damage (snow, water, sand, etc.) by high-strength aluminum waterproof boxes. The same metal is used for pebbles and various other parts.

Steering. - The steering wheel controls the front wheels as in a regular car, it also actuates the rear hub brakes, which allows to vary the relative speed of the two tracks and, therefore, to facilitate the execution of the turn. This result is obtained by the following device: the rear hub brakes are placed on the

inner halves of the drive pulleys. The cables of the two brakes lead to a lifter connected by its center to the handbrake control, while its ends are connected directly by cables to the lower end of the steering rod on which they wind more or less, so as to act automatically, as needed, on one or the other caterpillar.

Speed reducer. - To allow the snow car to cross steep slopes, the manufacturer added to the ordinary speed change, which has three speeds, a speed reducer by train ballader which halves the three primitive speeds, so that the car presented at the competition has six speeds, ranging from 3,600 km to 32 km.
In the competition cars, the speed reducer was controlled by a lever placed near the driver, to his right, that is to say in the middle of the wing, since in the "Citroën", the pipe is on the left. The result was a slight accident: the passenger next to the driver inadvertently touched the throttle, the gearbox was disengaged, the engine started and the car, driving on a steep snow slope, began to descend backwards. speeding. The sails were quickly replaced, but the control of the brake of the left track by the direction was suppressed. Despite this damage, the same car was able to continue the

competition without difficulty and to perform the following exercises the next day on the Sappey snowfield.

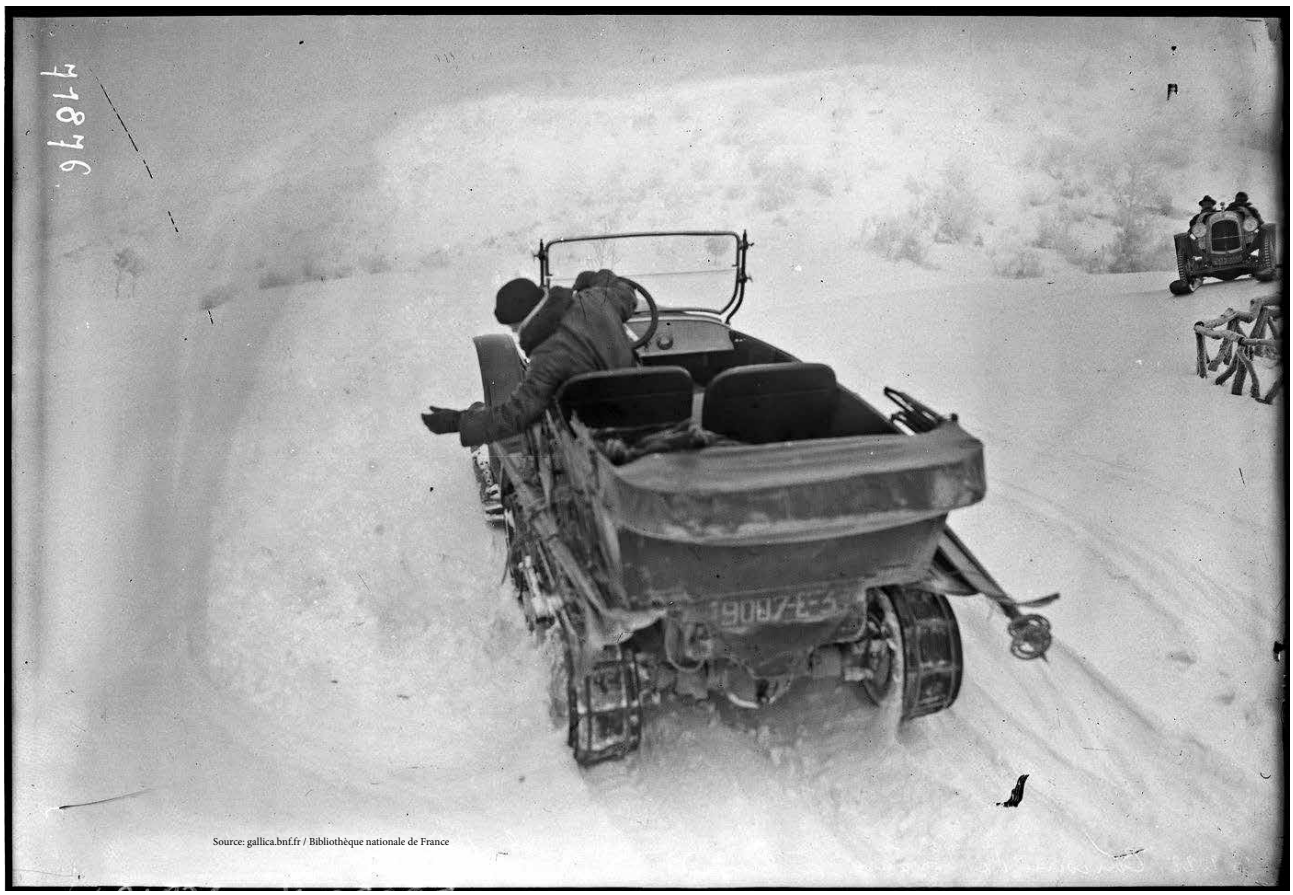
Skis. - The removable skis, whose front wheels must be equipped to move on the snow, are constituted, as the photographs show, by two flexible steel sheets superimposed and assembled only in their central part, which gives them the greater flexibility. The fastening system allows to fix them in a very safe way.

2) Car called "Tous Terrains". - The engineer Kégresse built, a variant of his thruster which interests more directly the military services, it is the propeller said, "All terrains". It differs from the previous one:
1- By the smaller width of the flexible band of the caterpillar and the arrangement of its external projections which he tried various models, including a device in herringbone;
2 - By the carrier system which is simplified and does not include the transverse balances, nor the small inferior rockers. The half rollers are independent in each file; on the other hand, each half-roller rotates on the same axis as the symmetrical half-roller of the other file, so that there is only one row of plunger cylinders.
The coil springs bear directly on the

bottom of the cylinders.
For a car of the same strength as the snow car with eight half-rollers on each side, there are only six half-rollers.
Finally, the adjustment of the tension is obtained, not by a rack, but by a worm. A crank that is placed on the square of the pinion allows this setting instantly.
While for the snow car, the manufacturer admits a pressure on the ground of 100 to 150 grams per square centimeter, he adopts for the car "All Terrain" from 300 to 400 grams.
That is, as the width of the track of the snow cars that took part in the competition is 24 cm for a spacing of the pulley axes of 1 m 40, while that of the caterpillar of the same cars equipped with "Tous Terrains"is only 15 centimeters for a spacing of the pulley axes of 1 m 15. For a truck of 2 to 3 tons, the width of the track for "Tous Terrains" is 27.5 cm for a spacing axes of 2 m 50.

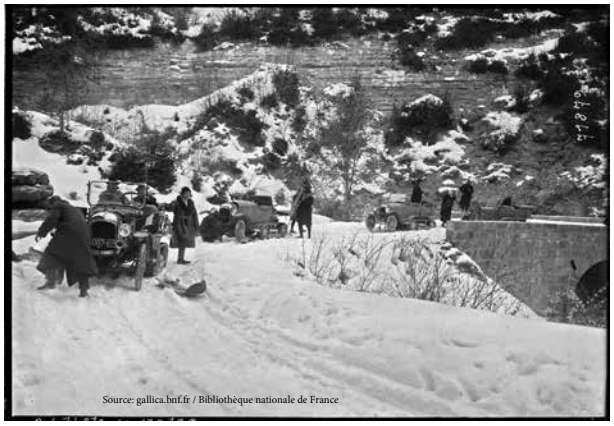
Various observations

a) The replacement of the Kégresse-Hinstin soft-caterpillar thruster with ordinary pneumatic wheels only decreases the speed of a passenger car by approximately 35%. The average speed obtained during the competition



in very rough terrain was about 15 km per hour. But it should be noted that in fast-turn descents such as those of Sappey, Grenoble, or had to moderate the pace to avoid accidents. On a flat horizontal road without snow, the car presented at the competition easily makes 30 km per hour. With heavy goods vehicles for which no high speed is desired, it should be anticipated that the loss of speed due to the replacement of the rear wheels by the Kégresse-Hinstin flexible tracked propeller will be less important.
As soon as we approach steep slopes, there is no longer any comparison of

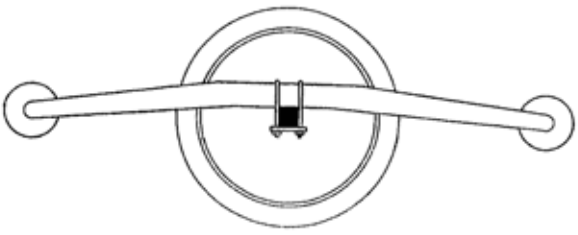
speed to establish with the wheeled wings that are quickly established, while the wing "All Terrain" mounted without any difficulty and at a good pace the embankments of the fortifications of Paris, for example, that is to say on slopes of 60% and descends likewise, as slowly as you want.
b) On uncompressed but frozen snow, the snow car does not sink at all. On the fresh snow, it sinks a few inches and spawns with ease a passage where a second similar car no longer sinks at all.
c) Snow, even ice-cold, does not attach to the rubber track, which en-



sures the retention of grip.
d) The bearing of the track is absolutely silent.
e) It absolutely does not cause any damage to the wheel, which is understood by the fact that the unwinding is absolutely regular and that there is no friction on the ground because of the great adhesion. For the same reason and because of the uniform and constant distribution of the load, the rubber band does not heat and its wear is insignificant.
f) The time required to replace a track is very short, and less than that required for tire replacement. We can also choose the moment when it is more convenient to carry out this operation, while the replacement of an exploded tire must be done at the place of the accident.
g) For a competition-type car, 4 hours are sufficient to remove the Kégresse-Hinstin thruster and convert it into a regular wheel wing or to perform the reverse substitution. For vehicles of a higher tonnage, it would obviously take a longer time, but the operation can always be done anywhere and quite quickly.

Crossing, obstacles and cuts. - The wings equipped with the Kégresse-Hinstin thruster can cross obstacles with straight edges, such as small vertical walls of 0 m 30 to 0 m 40 in

height by the sole pushing force of the track which causes the lifting of the front wheels, few loaded, above the obstacle.
For larger obstacles, the manufacturer has provided a device that allows, for example, the truck of 2 to 3 tons equipped with the thruster Kégresse-Hinstin to pass a sharp cut (walls in



good masonry 1 m wide).
This device comprises two rockers provided with rollers at each end and fixed on the front axle inside and against each of the wheels, so that when the wheels go down into the cut, the front rollers of the rockers carry the the other side and thrust of the propeller pushes the wheels up on the other side (see figure).
The propeller itself is equipped at the front with a similar half-pendulum which also allows it to cross the cut.

History. - It is perhaps not indifferent to say here a few words on the origin of the thruster Kégresse-Hinstin.
Mr. Kégresse was before the war Technical Director of the Imperial Garages of Russia since their creation (1906) until the revolution of 1917. Due to the impossibility of practically driving in winter on most Russian roads, he began studies in 1909 to solve the problem of mechanical transport on snow. After a large number of demonstrations and tests, the Russian War Ministry commissioned the Poutiloff factories to supply 200 flexible power-lift aircraft for armored cars, 3-ton trucks and snow-cars, and to the Russian-American Petrograd factory "Treuugolnik".
»More than 500 endless bands. Other applications to war engines were also well under way when the Russian Revolution arrived, in particular a full-length caterpillar armored car with a flexible endless belt and an army, a real battle tank at great speed.
Unable to resume his business in Russia, Mr. Kégresse returned to France in 1920 and joined Mr. Jacques Hinstin for the exploitation of numerous patents relating to his invention.
The first tests performed on four 10 HP Citroën cars excited the manufacturer who ensured the exclusivity of the Kégresse system and the collaboration of MM. Kégresse and Hinstin.
In addition to the competitions of 1921 and 1922 in which snow cars took part, other demonstrations were made in September 1921 in the sands of the dunes of Arcachon with the cars "All terrains".
Currently, the builders are preparing for the crossing of the Sahara for next October. From now on, refueling cars are servicing Touggourt in Ouargla (distance, 180 km) through the desert sands without any difficulty and much cheaper than the four-wheeled Fiat van that used to do this

service.
frequent damage and double fuel consumption. The last photograph shows the Citroën K.-H refueling cars in the Sahara, south of Ouargla, on the Hassi-Inifel road.

Conclusion. - From all the foregoing, it can be concluded that the Kégresse-Hinstin thruster is destined to receive many applications by its adaptation to military vehicles, both for those who will have to travel in the upset terrain of the forward zone of a Modern battlefield in Europe, only for those to use in the colonies in the regions not provided with a good road network.

Chief of Roux Battalion.

List of cars in this trial, all Neige models

9007-E3	5 pl.	Touring	dark
2280-W1	2 pl.	bobtail	light
2273-W1	2 pl.	open	light
2271-W1	5 pl.	Touring	light
2272-W1	5 pl.	Touring	light
?	5 pl.	Touring	dark